The FOUNDRY

Volume 57
Number 23

Published
Semimonthly

CLEVELAND, OHIO, DECEMBER 1, 1929

Castings Carry Machine for Cleaning Ballast

ADEQUATE drainage is one of the important advantages resulting from the use of stone ballast for railroads. However, the ever falling stream of cinders from passing locomotives tends to fill the openings between the stones and after a time becomes necessary to clean the ballast to remove the cinders. A special

Courtesy Fort Pitt Steel Casting Co.
Steel Castings Have Replaced Assembled Sections on This Ballast Cleaning Machine

stone ballast cleaning machine has been developed for this work, which travels between the tracks, digging up the ballast, removing the cinders and relaying the stone. While the machine is constructed almost entirely of castings, the special cast racks upon which the machine travels are of greatest interest to the foundrymen, since they have replaced racks produced by other methods of fabrication. The racks first were made of structural steel riveted together to form the completed track. The built up track weighed 113 pounds and consisted of 32 parts requiring 164 machining and 21 assembling operations. Weight, of course was an important factor to be considered in the design of the cast part, since excessive weight would prevent the use of cast steel. The cast steel rack weighs only 114 pounds, is all in one piece and requires only 12 machining operations. Thus the substitution of castings for structural steel has eliminated 31 parts, 152 machining and 21 assembly operations.

Find Where Castings Can Be Sold

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PUBLISHED BY THE PENTON PUBLISHING CO., CLEVELAND, O.
BRANCH OFFICES

CHICAGO ..... 1347 Peoples Gas Bldg.
CINCINNATI ..... 209 Edwards Bldg.
NEW YORK ..... 2203-2206 No. 220 Broadway
PITTSBURGH ..... 2148-49 Oliver Bldg.
SAN FRANCISCO ..... 24 California Street
WASHINGTON, D. C. ..... 1653 Pennsylvania Avenue
LONDON, ENGLAND ..... 416-417 Caxton House, Westminster, S. W. 1
BIRMINGHAM, ENGLAND ..... 14 New Street
PARIS, FRANCE ..... No. 9 Rue de Londres
BERLIN, GERMANY ..... Dahlmerstrasse 64A, Berlin, Lichterfeld-West

Cable address, IROTRAPEN, London

SUBSCRIPTION

United States and Mexico ..... $3.00 a year
Canada ..... $4.00 a year
Great Britain and other Foreign Countries ..... £1:0:0 a year
Single Copies ..... 25 cents

Copies published three months or more previous to date of current issue, 50 cents each.

Member, Audit Bureau of Circulations, Associated Business Papers Inc., National Publishers' Association

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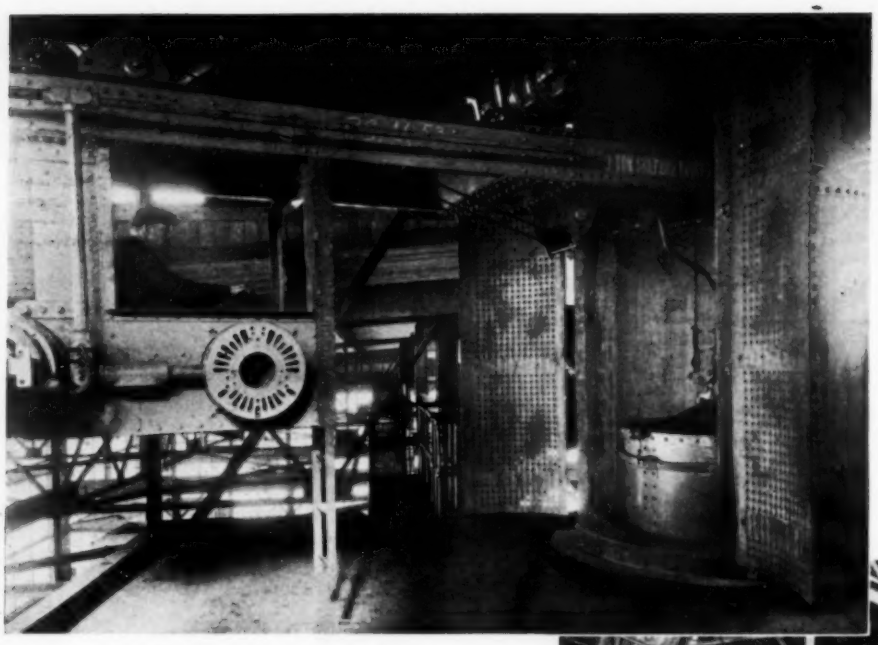
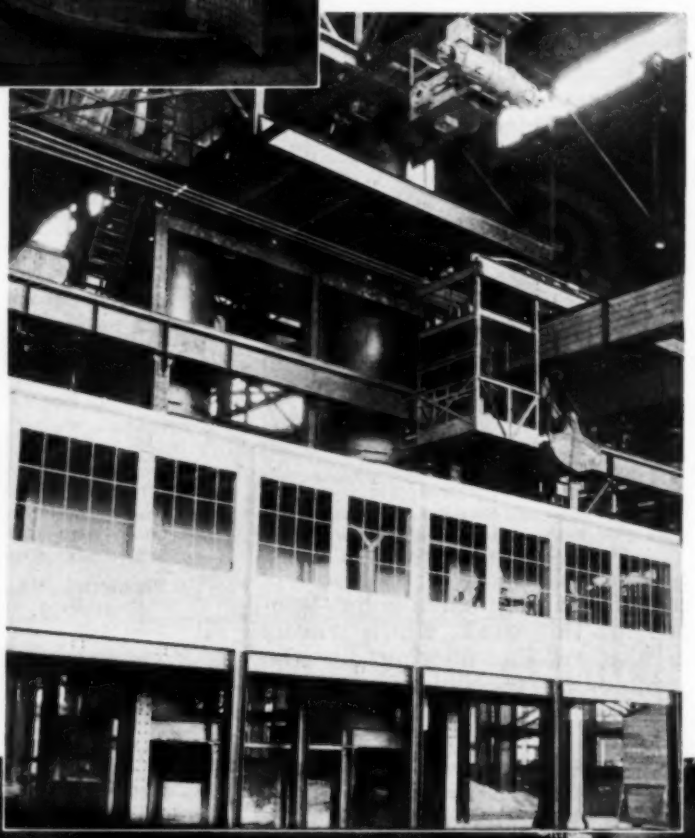
POURS





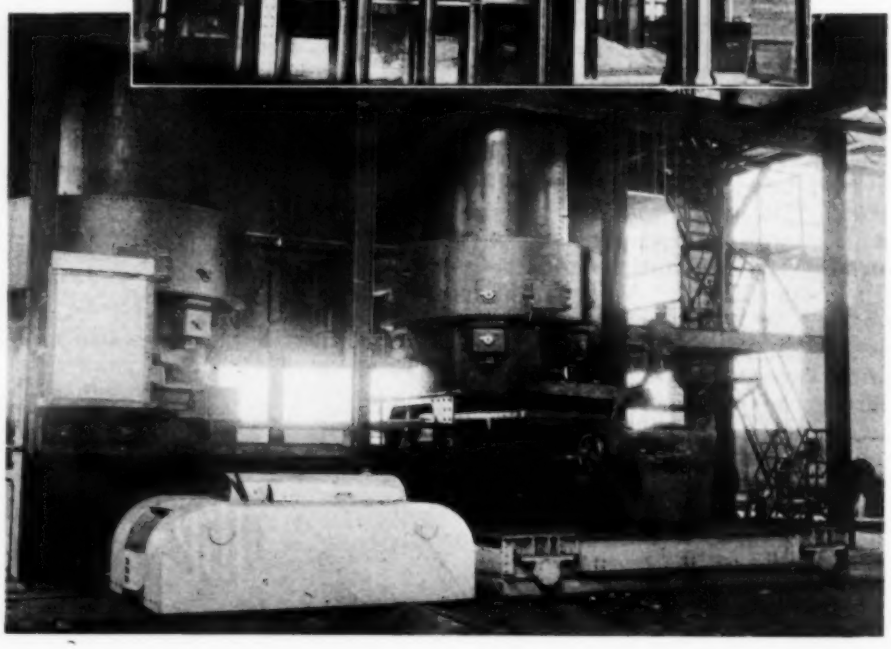


Fig. 1 (Left) — The Charging Hoist Lowers the Bucket Into the Cupola. Fig. 2 (Center) —Charging Doors in These Cupolas Probably Are Higher Than Any Others in This Country. Fig. 3 (Bottom)—A Special Cover Protects the Tractor From Sparks and Splashes. The Low Car Conveys the Metal to Any Desired Bay

IN A certain old, sentimental song, familiar in recent years to practically every person through the activities of the ubiquitous radio, the author indicates the passage of many, many years by the line "The creaking old mill is still, Maggie, since you and I were young."

The inference naturally is that ceaseless activity over a prolonged period of time exhausted the old mill and that after one final, dispirited creak, it ceased to function. As a matter of plain, cold, everyday fact, the owner of the mill probably shut it down when the introduction of artificial ice cut off his revenue from ice harvested from the old mill dam in winter.

Another old song out of the past, warned all and sundry that "The mill will never grind with the water that is past." *Is Past* is poor grammar, but let that pass. Every person knows that the mill owner could not make a living if he depended exclusively on the water which flowed over or under the old mill wheel. While it is true that the water which passed, never will return, one must not forget that a certain volume of water in the dam never passed through the mill race. Nevertheless under former conditions, the miller levied on both for his income and probably derived as much from one as from the

Ice Machinery Castings

In New Foundry

By Pat Dwyer

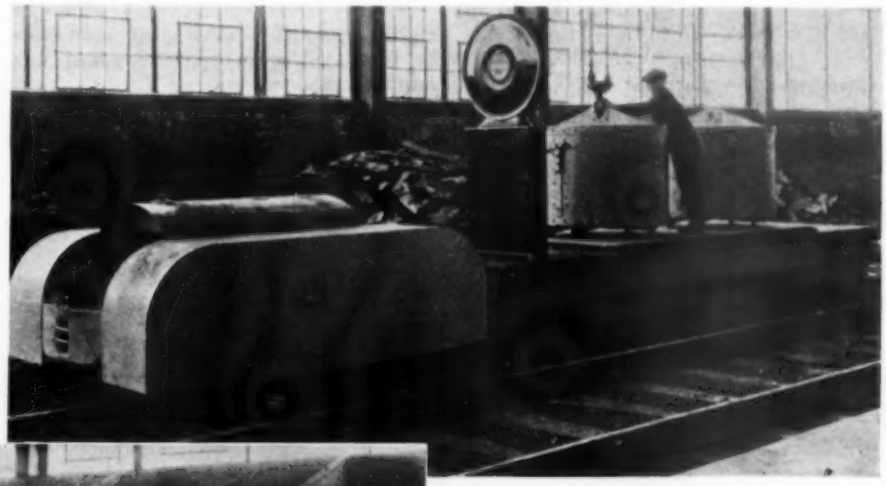
other. One in the summer and the other in winter.

In the winters of the eighties and early nineties he paid approximately 20 cents per ton for harvesting the ice crop on the standing water. During the following summers he hawked the ice around the community. His collection of nickels, dimes and an occasional quarter, amounted to about $5.00 per ton of ice delivered.

Even after deducting shrinkage, depreciation, distribution costs and all the other items which cause such a rapid evaporation of anticipated profits, it is apparent that the ice crop from the old mill dam paid for most of the butter and all of the jam on the miller's bread.

In a comparatively small number of places, natural ice still is collected from the mill dam, pond, lake or river. After a particularly bitter, cold snap, old Dobbin is hitched to a special plow and the surface of a selected sheet of ice is heavily scored into 3-foot squares. A special saw is employed to complete the cut and then each block in turn is pried away with a steel bar and guided in the water to a point where it is gripped with a pair of tongs and either pulled up along a slippery runway, or, lifted bodily by a tackle, into the ice house, where it is insulated in sawdust. Fine, healthy, out door work for men who are fond of horses, and whose ambition lies toward north pole exploring.

However, and this applies particularly to the cities, practically all the ice consumed today is manufactured and distributed as readily as loaves of bread in and from a bakery. Plants are erected to turn out a definite quantity of ice each day irrespective of the season and with no dependence whatever on the prevailing temperature. In addition to the great manufacturing ice plants designed to serve the miscellaneous public, singly and en masse, many public and private institutions maintain and operate ice-making machinery to supply their own wants.



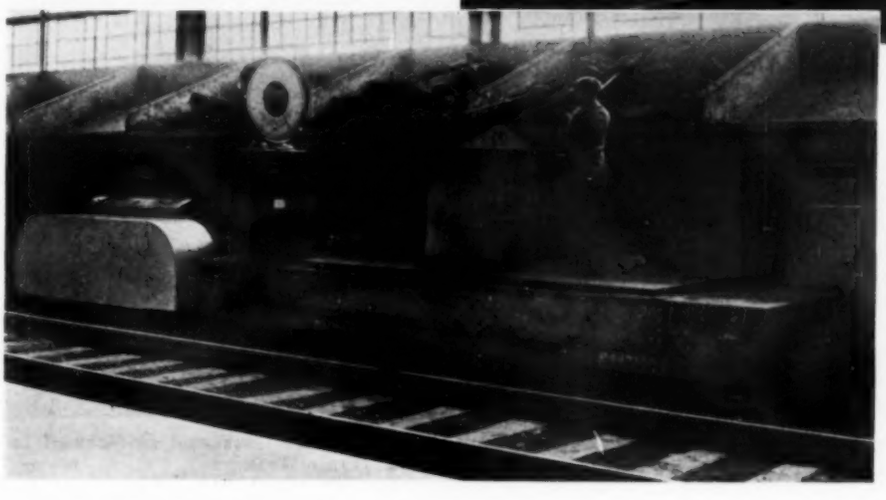


Fig. 4—The Charging Bucket Is Mounted on a Scale Car Towed by a Tractor. Pig Iron and Scrap Are Stocked in the Space Between the Chutes and the Wall. Fig. 5—Full and Empty Buckets Are Exchanged by the Charging Hoist

One typical example may be taken as indicative of the trend from natural to artificial ice. In the 20-year period up to and including 1905 the ice cut on the Hudson river and consumed principally in New York city, increased from year to year until in 1905 it amounted to 3,661,800

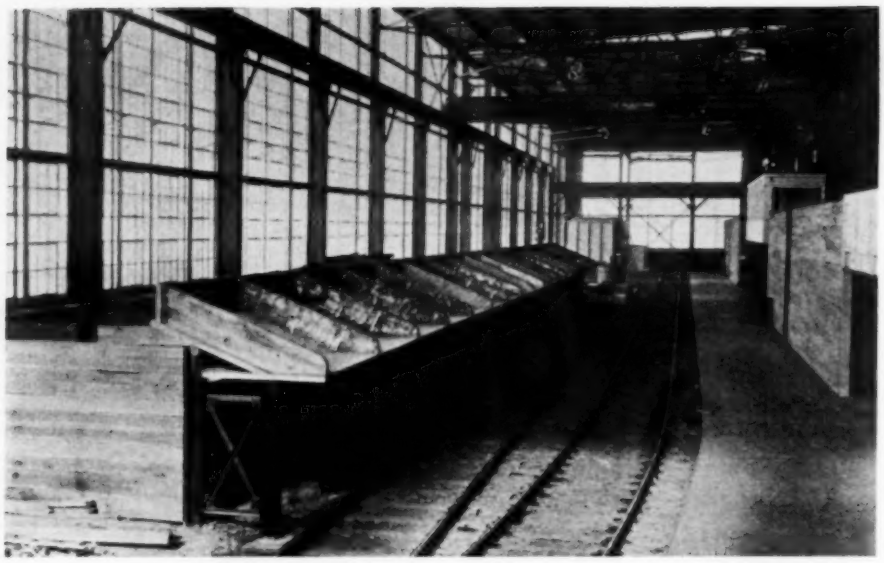


Fig. 6—General View of Stock Bay with the Iron and Coke Bins on the Left and the Sand Bins on the Right

tons. In the following year it showed a marked decline and then fell off rapidly until in 1924, the latest figures available, it only amounted to 242,631 tons.

Without stating it as an absolute fact, still one reasonably may assume that the same conditions prevail throughout the entire country. This view is strengthened by the *Biennial Census of Manufacturers* for 1925 issued by the United States department of commerce, which shows that the annual output of artificial ice in that year was 40,163,864 tons, valued at $186,909,036.

Adoption of artificial ice and iceless refrigeration has moved with ever increasing acceleration and the comparatively small number of plants engaged in the production of the necessary machinery have been taxed to capacity, particularly in recent years. To meet the present demand, and the greater anticipated demand in the future, the York Ice Machinery Corp., York, Pa., recently erected and placed in operation, a new plant in Grantley, a southern suburb of the city.

Plant Over Crowded

This does not mean that the original plant has been abandoned. It simply means that the old plant, occupying four city blocks had become congested to a point that interfered with efficient operation and no further land was available in the vicinity. Several departments were removed to the new location and those which remained have extended their activities into the vacated locations.

The history of the plant shows a constant series of expansions since one Thomas Shipley engineer, inventor, ice machinery expert and president of the corporation, took it over as a wabbling infant about 32 years ago. Combined application of heroic treatment and strong medicine caused the infant to wax lusty and strong. Larger quarters became necessary. Land adjacent to the original plant was bought and buildings were erected. This program was repeated several times even to the extent of razing dwellings to make room for factory expansion.

Picks New Location

Several years ago Mr. Shipley's highly trained sixth sense—sensitive as a needle to the pole—warned him that further expansion was on the way. As a preliminary measure he secured a tract of 84 acres in a certain section of the city where 84 acres were available at a much more attractive figure than elsewhere. Thus when the decision was reached to erect new buildings for a supplementary plant, this elegant site was ready and waiting. The new group of buildings covers almost as much area as the parent plant, but the present description is confined to the foundry occupying approximately 4 acres and representing the most modern features in construction and operation.

Visit Other Plants

Personal visits of Mr. Shipley and members of his staff to various notable foundries erected throughout the country in recent years, furnished the necessary background for drawing up a set of plans for the new foundry. Under these conditions it was inevitable that some features seen on the tour were adopted whole heartedly, others were condemned just as enthusiastically and others were adapted and changed to a greater or lesser extent before they received the final O. K. For several years the foundry in the old plant had been operated under the most difficult conditions and frequently figured prominently in conferences called to decide what was holding up the orderly process of production. Naturally all this was extremely annoying to an inventor-engineer-president who had devoted practically all his life to the development and manufacture of such a smoothly running piece of mechanism as an ice machine. In effect he let it be known that he wanted a foundry that would function as quietly and smoothly as one of the machines and what was more to the point he intended to keep his own

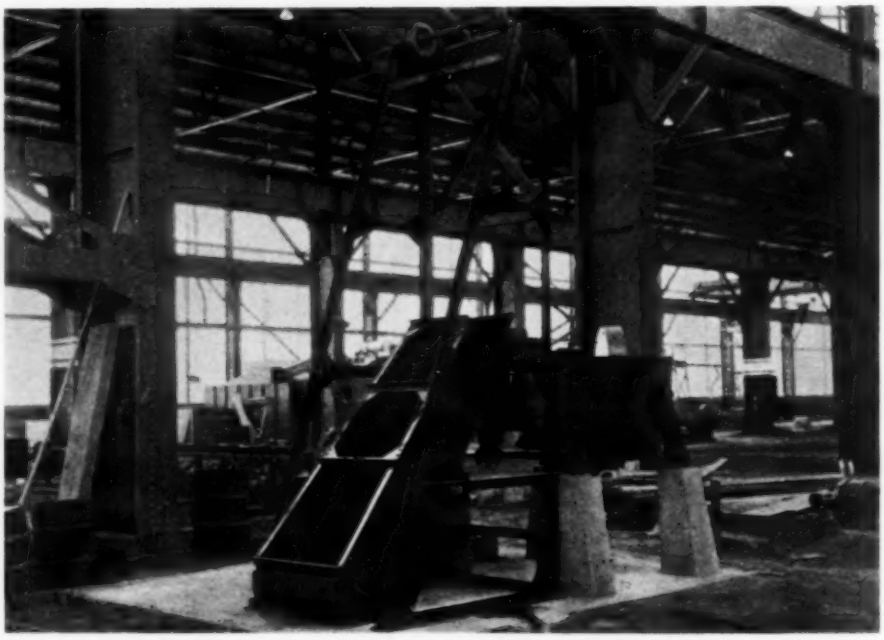


Fig. 7—Prepared Facing Is Removed from Under the Pan and Is Carried to the Foundry Floor in a Dump Truck

eye on, and finger in, the job until it was done. Apparently he has got what he wanted.

An exceptionally heavy steel frame supports the crane runways and roof. With the exception of a brick wall 6 feet in height, the remainder of the side and end walls is made up of steel window sash with a swinging section in each division for controlling the ventilation. A monitor roof over each bay except the first and eighth, also carries windows in each side for the entire length and thus diffuses daylight over every square foot of the floor. Push button control at a convenient height on the end wall operates a long horizontal shaft mounted on brackets close to the center section of each line of monitor windows. The shaft is attached to each window section through a suitable bracket and lever arm and pulls them into the open or closed position as desired. The motor for operating the shaft is mounted at a point approximately midway from the ends.

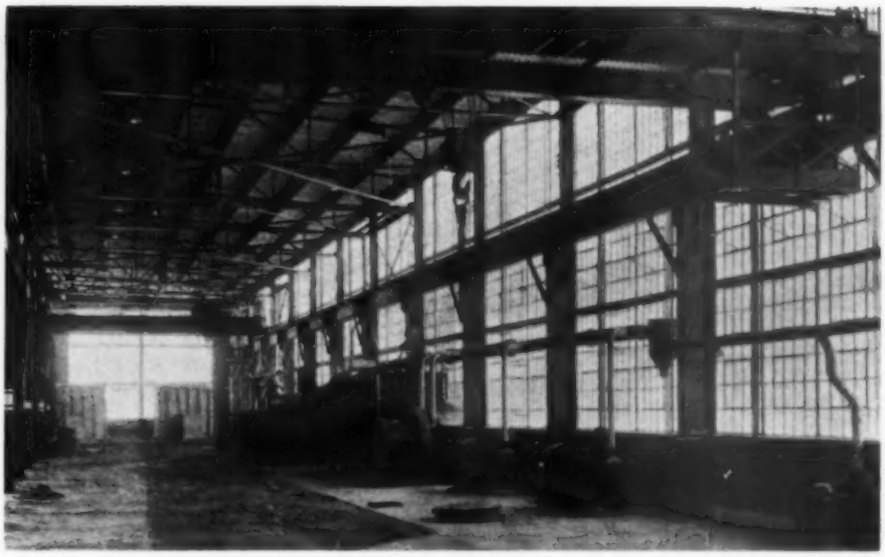


Fig. 9—The Cleaning Bay Is Equipped with Tumbling Barrels, Sandblast Units, Pickling Tanks and a Hydraulic Department

Low Shipping Rates

General location of the foundry and the floor layout are shown in the illustration Fig. 11. A line drawn from north to south or from east to west will pass through diagonally opposite corners. One of the peculiar features of this foundry is that the flask storage and the stock yard are included under the same roof as the remainder of the foundry. The flask storage occupies bay No. 1 on the southeast side of the building. The stockyard occupies a transverse bay 60 feet in width that extends all the way across the southwest end, shown to the right in the illustration.

All the raw material enters at the south corner, flows into the various bays and is manipulated according to requirements. The castings are shaken out and carried into bay No. 8, the one shown at the bottom of the illustration. After they have been cleaned they are taken to the loading dock at the extreme north, or lower left corner and loaded either on trucks or railroad cars for shipment to the machine and assembly shops in the parent plant about 1½ miles distant. Through a particularly favorable arrangement with the railroad, the castings are delivered at as low, and in some instances, lower cost than when they were made and shipped from the old foundry in the heart of the plant.

The building 400 x 460 feet is almost square. Curiously enough the 400-foot dimension is the width of the building and is made up of eight 50-foot bays. Only one of the bays is 460 feet in length, that is No. 8, shown at the bottom of the illustration and extending 50 feet beyond the remainder of the building at the lower left corner. The remaining seven bays are approximately 300 feet in length and extend from the transverse bay at one end of the building to a row of auxiliary departments, office, locker rooms and brass foundry, at the other end. A wide gage track and a wide gangway also extend across the ends of all the bays and facilitate the movement of materials across the width of the building.

Fig. 8—Coke Storage Bin in Process of Construction. The Coke Is Loaded Over the Top

Operate Many Cranes

Taking the bays in regular order as they are shown in the accompanying sketch and reading from top to bottom, the first bay is devoted almost exclusively to the storage of flasks. It is spanned by a 20-ton crane, which like all the other traveling cranes in this foundry was made by the Shepard Niles Crane & Hoist Corp., with head office in Montour Falls, N. Y., and plants in Montour Falls, N. Y., and Philadelphia.

Besides the 20-ton crane in the flask bay, the list includes one of 20 tons capacity in bay No. 2, one of 20 tons in bay No. 3, one 20 and one 30 tons in bay No. 4, one 30-ton crane in bay No. 5, one 20-ton each in bays No. 6 and 7, one 20 and one 30-ton crane in bay No. 8, one 10-ton crane with grab and magnet and one 3-ton charging crane in the transverse bay or stock yard shown to the right of the illustration Fig. 11.

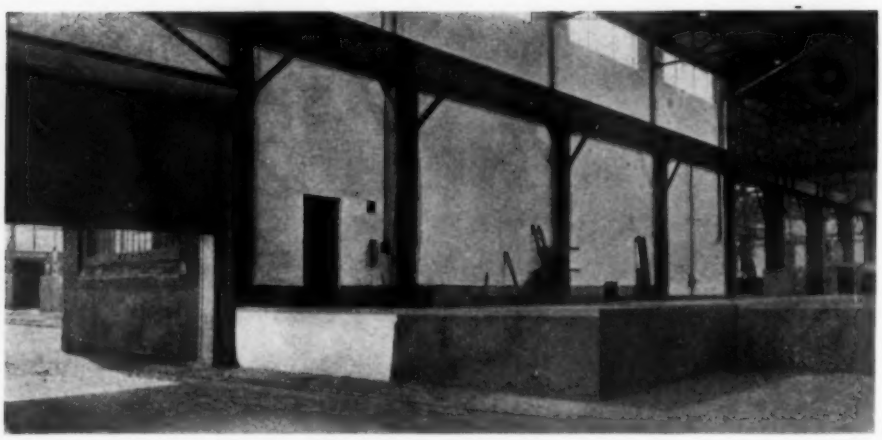


Fig. 10—End of the Cleaning Bay Terminates in a Ramp from Which the Castings May Be Loaded Into Trucks or Railroad Cars. The Crane Runway Extends the Entire Length of the Bay

These are supplemented by several small jib cranes erected in the vicinity of molding machines. From the foregoing it is apparent that the crane service is adequate for all present and considerable future requirements.

The left end of No. 1 bay is fitted with the necessary tools and facilities for repairing flasks and other pieces of foundry equipment. Part of the space also is occupied by two batteries of core ovens designed and installed by the Foundry Equipment Co., Cleveland. Small cores are loaded on racks and carried into one battery of three on lift trucks. Large cores are loaded on cars and taken into the second battery of four ovens. The bodies of the ovens and the firing pits are located in bay No. 8. The doors are flush with the row of columns which separate bay No. 8 from bay No. 7. The ovens are fired with oil.

Assemble Cores

Molding sand and core sand are stored in five large concrete bins between the transverse bay at the southwest end and the longitudinal bays. The roof of the bin nearest the south corner that is at the end of No. 2 bay, serves as a mixing platform on which the core sand mixtures are prepared in a paddle type mixer made by the Blystone Co., Cambridge Springs, Pa., and in a roller and pan device made by the National Engineering Co., Chicago. A larger unit of the latter type is located close to the end in bay No. 6 where it is utilized for preparing facing sand. It is equipped with a loading bucket into which the required quantity of material for a batch of facing, is placed while the rollers are mulling the preceding batch in the pan. When the first batch is ready it is discharged through an opening in the bottom. The loaded bucket is elevated immediately and the contents are dumped into the pan. In this manner, continuous operation is assured.

No. 2 bay is devoted exclusively to coremaking. The small cores are made on benches on both sides of the bay nearest to the sand mixers. Larger cores are made on the floor and on a jolt machine made by the Herman Pneumatic Machine Co., Pittsburgh. Each coremaking division occupies approximately half the floor space in No. 2 bay.

Prepared sand for the small cores is taken from the mixer in a wheelbarrow and carried along a platform which extends above the coremaker's benches on both sides of the bay. The sand is dumped through an opening in the platform and falls through a chute to the bench. Sand for the large cores, mostly a coarse loam, is dumped from the mixer through a chute leading to a bucket on the floor. The bucket is picked up by the crane and taken to the heavy coremaking locality.

Dried cores are taken into bay No. 3 on a transfer car. Here they are assembled and inspected. Most of the larger cores are taken directly to the molding floors where they are placed in the waiting molds. A considerable number of the small cores are stored in a series of racks that occupy part of this bay. Core production, distribution and other items are recorded by a clerk stationed in this store room.

Molding Floors

Molds are made under a variety of conditions in bays 4, 5, 6 and 7. Interesting features in connection with some of the methods are described in a second article to follow in a later issue. Many of the molds are dried in a battery of four large car type ovens made by the Foundry Equipment Co., Cleveland. These ovens are oil fired and the tracks extend into bay No. 6 where the cars are loaded and unloaded. Molding machines in this foundry were supplied by the Osborn Mfg. Co., Cleveland, Herman Pneumatic Machine Co., Pittsburgh, Tabor Molding Machine Co., Philadelphia and Beards-

(*Concluded on Page* 998)

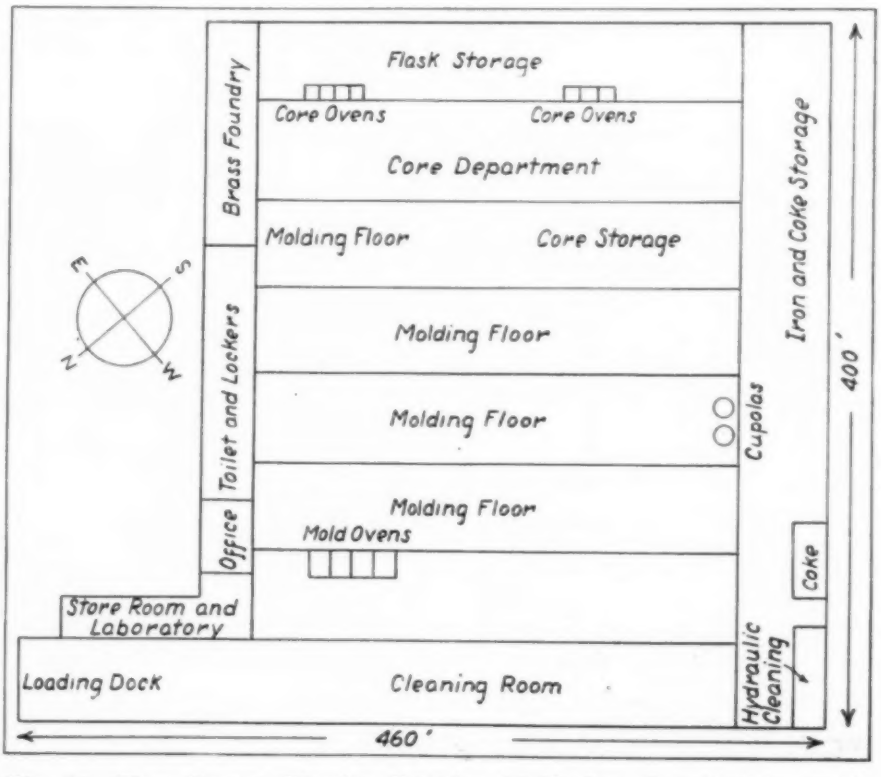


Fig. 11—Floor Layout Showing Location of Various Departments in the Foundry

British Foundrymen Cast Variety of Alloys

Part III—Yellow Metals

By Thomas H. Turner

DUE TO the relative ease of casting and resistance to corrosion, alloys rich in copper, grouped under the heading of yellow metals, are manufactured in the greatest variety of compositions and mechanical properties. Common brass castings are made mostly from scrap metal, and therefore contain up to 2 per cent of unintentional foreign elements as well as the usual 60 per cent copper and 40 per cent zinc, which most foundrymen profess to aim for in such castings.

Specify Physical Properties

A specification for this class of material (B.E.S.A. B.14-1918) calls for 55 per cent copper as a minimum, and not more than 2 per cent total impurities, including lead, the remainder being zinc. These common brass castings must give the following minimum figures from tensile tests: Ultimate tensile strength, 33,600 pounds per square inch; yield point, 13,440 pounds per square inch, and elongation, 15 per cent.

The corresponding admiralty brass specification requires 62 per cent copper, 1 per cent tin and the remainder zinc; only 0.75 per cent impurities are permitted. One per cent tin is deemed beneficial for all brasses in contact with sea water.

For much general work, 60 per cent copper, 39 per cent zinc and 1 per cent tin, with varying amounts of lead, is cast, and for railway window frames and similar somewhat superior cast brass 66.5 per cent copper and 33.5 per cent zinc is specified by the users.

For bearings of the copper rich type, phosphor bronze usually is specified, for high duty purposes, in accordance with B.E.S.A. B.8-1917, some details of which are shown in Table XV.

For bearings subjected to lower loads, the use of a plastic bronze is made in which tin, zinc and lead are found. These usually are made to special specifications, a typical one being given as follows: Copper, 80 per cent; zinc, 7 per cent; tin, 6 per cent and lead, 7 per cent. This alloy has an ultimate strength of 26,880 pounds per square inch; an elogration of 10 per cent, and brinell hardness is 60.

Gun Metal Is Popular

Where resistance to corrosion is essential, the so-called admiralty gun metal is extremely popular, and commonly is spoken of as 88-10-2 alloy. The specification which actually is used most at the present time for this type of work appears to be B.E.S.A. B.2-1917, but admiralty electrical bronze, or 87-7-3-3 alloy also is used much by foundrymen for many castings, owing to its excellent casting properties. Typical compositions of gun metals now cast in Great Britain.

Make Copper Alloys

RESISTANCE to corrosion and ease of casting are two properties of alloys rich in copper that makes these metals desirable for many purposes. In this country these alloys are made in varying compositions, and the same holds true in Great Britain according to the author. In this article, which is the third of a series describing metallic alloys cast in Great Britain, the various copper alloys grouped under the heading of yellow metals are given with compositions and physical properties. This article is abstracted from a paper presented at the meeting of the Association Technique de Fonderie de France in behalf of the Institute of British Foundrymen.

Table XII

B.E.S.A. Special Brass Castings

(Spec. No. 208-1924)

Class	1	2	3	4	5
Minimum Copper Per cent....	54	54	54	50	50
Maximum total of metals other than copper and zinc	5	5	8	10	13
Zinc	Remainder in all cases				
Minimum ultimate strength, pounds/sq. in.	62,720	71,680	76,160	85,120	100,800
Minimum elongation, per cent	25	18	15	15	12
Proof Stress, pounds/sq. in.	26,880	33,600	39,200	44,800	56,000

Table XIII

Nickel Toughened Yellow Metals

(Exhibited at the London Foundry Exhibition, 1929)

Nickel Per Cent	Ultimate Strength Lbs./sq. in.	Elongation on 2 inches	Uses
1-1.5	35,840-40,320	15-25	Nickel toughened gunmetal for dynamo end bearing frame and retaining ring
5	31,360-40,320	10-15	Superheat steam bronze for large slide valve and small turbo generator bucket wheel blank
2-3	35,840	4- 6	Nickel toughened bronze for small slide valve
1-2	26,880-35,840	5-10	Nickel toughened bearing bronze for dynamo slip ring
0.5-1	33,600	4- 6	Nickel toughened pump bronze for impeller guide ring
1	78,400	25	Nickel toughened manganese bronze for launch propeller
1-2	38,080-44,800	4- 8	Nickel toughened gearwheel bronze for automobile worm wheel

Table XIV

Complex Brass Alloy

Typical Chemical Analysis

Copper	59 per cent
Zinc	37.5 per cent
Iron	2.0 per cent
Manganese	1.0 per cent
Tin	0.5 per cent
Pb, Al, Mg	Nil

Physical and Mechanical Properties

Ultimate strength....72,720 pounds per sq. in.
Yield Point .....31,360 pounds per sq. in.
Elongation on 2 inches .....20 per cent min.

are given in Table XXI on page 995.

Bell metals cast in Great Britain are true bronzes with 17 to 25 per cent tin. As a rule 20 to 24 per cent tin is preferred. They are hard and brittle, with no elongation, and an ultimate tensile strength of 33,600 pounds per square inch. Silver is not added now, but up to 4 per cent lead often is present. These alloys are typically gray-white in color, and frequently spotted with gold and yellow patches.

Have High Tensile

So-called manganese bronze castings are generally high tensile, complex brasses, and they are often employed as substitutes for steel castings, especially where urgency of delivery is a prime consideration, or when small numbers of the particular castings are required. Its use in this respect, although often resorted to, is not general, on the score of expense. The specification given for its physical and mechanical properties is similar to that quoted for steel castings, and a typical one, used in the foundry of an engineering firm visited, is given in Table XIV with analysis.

Observation in service has shown that failures of castings in manganese bronze used as substitute for steel castings have been remarkably few, and these have been traceable generally to unsoundness, which incidentally, is the most severe problem to overcome in the casting of these alloys.

Specifications for some high tensile brasses now used are shown in Table XVI. The use of the name manganese bronze for many of these alloys, instead of the nomenclature accepted by the Institute of Metals, dates from the invention and patenting in England, in 1876, of an alloy of this type. This is still known as Parsons manganese bronze, and is cast for ships' propellers and for all kinds of steamship work. Its composition and properties are given in Table XVII.

Many thousands of tons of ships' propeller castings have been made from similar alloys, in which the zinc is slightly higher, and nickel and manganese replace some 4 per cent of the copper. This second alloy withstands better the erosion and water hammer action encountered in running large vessels. One British foundry, which has cast propellers for many of the better known Atlantic liners and for the largest battle cruiser afloat, distributes the alloy they have used for this purpose under a trade name, and informs the author that its typical properties are, approximately, as given in Table XVIII. This foundry also casts a series of special alloys under a proprietary name. One of these has an ultimate strength of 112,000 to 156,800 pounds per square inch; an elongation from 15 to 20 per cent; brinell hardness from 200 to 210 and a specific gravity of 7.8.

Table XVII

Manganese Bronze

Composition	Per Cent
Copper	56-58
Zinc	40-41
Iron	1- 1.5
Manganese, Aluminum, Tin	Present in small quantities

Properties

Ultimate Strength, pounds/sq. in.	71,680 to 76,160
Elastic limit, pounds/sq. in.	35,840 to 38,080
Elongation per cent	20
Sp. Gr.	8.4
Brinell hardness	120

Table XVI

Composition of High Tensile Brasses

Composition Per Cent									
Cu	Zn	Sn	Pb	Fe	Mn	Al	Ultimate strength	Elongation	Uses
59	37	0.5	Nil	1.25 max. 2.0	1.5 max. 1.0	Nil	62,720	20	Admiralty Mn Bronze (Izod 15 ft. lbs.)
58	37	.....	.....	Fe + Mn + Al = 5 per cent			78,400	15	Mn Brass for turbine pump castings, etc.
57	41.25	1.00	.....	.....	.75	.....	73,920	15	H. T. Bronze
57	39	1.25	0.5	1.0	0.25	.....	80,640	20	Special Mn Brass
51	43	0.5	0.3	1.4	2.2	Nickel 1.75	89,600	19	Propellers

A proprietary range of special brasses and bronzes introduced by the late Walter Rubel is also now being cast under license by several firms, and these are again copper-zinc alloys, to which additions are made in varying proportions. Nickel, manganese, aluminum, and fraction of 1 per cent of iron are added, within well defined limits, in the form of a special temper alloy. The additions vary from 6 per cent to as much as 21 per cent.

Nickel Contents Are High

Table XIX gives examples of such alloys, and it should be noted that the latter two alloys, which contain 13 per cent and 17 per cent nickel respectively, recently have been employed extensively in high class shipbuilding. They are both silvery white in appearance when polished, but light yellow after long exposure. A British Engineering Standards association specification now exists for such remarkable, complex alloys (No. 208-

Table XV

Composition of Phosphor Bronze

Composition per cent						Properties		Uses
Cu	Sn	Zn	Pb	P	Mn	Ultimate Strength	Elongation	
89.0	9.5-10	1.5-1.8	.....	0.05	0.10	33,600	10	Admiralty
88.5	11	.....	0.2	0.3	.....			Automobile axle bushes
85-89	10-13	0.25 max.	0.25 max.	0.5 1.0	.....	22,400 min.	1½-4	Air Board (B.S.)
86.6	11.9	.....	.....	1.5	.....			Turntable centers
85.5	10	2	2	.....	.....			Gearbox bushes
85	8	3	3.5	0.5	.....			Gearbox bushes
84.6	14.6	.....	0.8	0.01	.....			Loco. slide valves
83	10	.....	6	1	.....			Anti-attrition
80.2	13.8	2.0	3.5	(remainder phosphor tin)				Locomotive slide valves
80	15	.....	5	trace	.....	29,120	5	"Bell" for packing rings
80	14	2	.....	(remainder phosphor tin)				Railway and Mill bearings
79.7	10	1.0 max.	9.5	0.8	.....			Large water-cooled Mill bearings
60	.....	.....	20	20 Nickel				

Table XVIII

Special Bronze Alloy

Composition	Per Cent
Copper	51.
Zinc	43.
Manganese	2.2
Nickel	1.75
Iron	1.4
Tin	.5
Lead	.3
Arsenic	Trace
Ultimate Strength, pounds/sq. in.	89,600
Elastic limit, pounds/sq. in.	42,560 to 44,800
Elongation per cent	18-20
Brinell hardness	180

1924), brief details of which are shown in Table XII.

Further particulars of the compositions of such alloys are to be found in the companion specification for special brass ingots for castings (No. 207-1924). The maximum lead content permissible in each of the five grades is 0.5 per cent and no one metal shall exceed 3.0 per cent in grades 1 and 2 or 5.0 per cent in Grades 3, 4 and 5, with the exception of copper and zinc. The proof stress specified in the table is applied for 15 seconds and removed, and must not produce a permanent elongation of 0.15 per cent of the gage length.

Used for Steam Valves

Particulars also are given in Table XIII of some special nickel toughened yellow metal castings, which were exhibited this year at the International Foundry exhibition by a well known British foundry.

These yellow metal alloys, with low nickel contents, from an intermediate group of alloys between the normal bronzes and the high-nickel, complex bronzes which generally are cast by specialist firms catering to steam users. For high-pressure, steam valves a number of alloys now are being cast which may be regarded as copper-nickel or monel metal, to which tin has been added. In some cases, further small additions of other metals are made, such as chromium, iron and manganese, but the alloys appear to be, in the main, tin-hardened copper-nickels.

In one foundry visited, valve parts for medium-high temperature steam are cast from an alloy containing copper, 75 per cent; nickel, 15 per cent; tin, 8 per cent and manganese, 2 per cent. However, a works metallurgist with an exceptional experience of these special castings informs the author that the best properties (89,600 pounds per square inch ultimate strength at ordinary temperatures; 44,800 pounds per square inch at 600 degrees Cent.) are obtained from those alloys which contain 40 to 50 per cent nickel and 10 to 12 per cent tin. These valve seating alloys have a brinell hardness of about 285 at ordinary temperatures.

Table XIX

Properties of Some Chill Cast Alloys

(Made by adding a temper alloy of nickel, manganese, aluminum and a little iron, to a copper-zinc base.)

% Copper plus zinc	% temper alloy	Ultimate Strength sq. in.	Elongation per cent	Brinell hardness	Sp. Gr.	Principal Uses
91	9	62,720-78,400	20-35	800-100	8.3	Constructional, Propellers
89	11	78,400-98,560	8-18	150-160	8.2	Piston rings, Rotor Covers
84	16	62,720-78,400	20-40	110-130	8.3	Superheated steam up to 400°C.
79	21	85,120-112,000	5-18	150-170	8.3	Superheated steam over 400°C.

Specific gravities of many proprietary bronzes betray the fact that they are complex aluminum bronzes, but under its own name aluminum bronze, as such, does not appear to have been adopted in Great Britain as a foundry alloy, to the same extent as it has been in some other countries. During the last few years it has attracted greater notice, and is now being chill and sand-cast for use in many industries.

Table XX

Brazing Metals

Cu	Zn	Pb	Name
91	9	....	Brazing Metal
83	17	....	Brazing Metal
80	20	....	Brazing Metal for copper pipes and flanges
52	rest	1.0 max.	Brazing Spelter

Gives Aluminum Bronzes

As the fatigue strengths of these alloys are superior to those of brass, bronze and phosphor bronze, and the specific gravity slightly lower, they merit more attention. In Table XXII, particulars are given of aluminum bronze as cast at a works visited by the author. Alloy No. 1 is said to be the easiest to cast, and is used almost solely on account of its excellent resistance to corrosion. It withstands cold weak sulphuric acid, and also weak hydrochloric acid, but cannot resist nitric acid. Alloy No. 2 is used for gears and other parts requiring strength, and No. 3 is used where the highest strength is required. These alloys have not been standardized, and the author is indebted to a foundry owner for these figures of

Table XXI

Composition and Properties of Gun Metal

Cu	Sn	Zn	Pb	Ultimate strength	Elongation	Uses
88	10	2	0.5	35,840	8	Admiralty
88	10	2	Max. 1			General work
88	8	2	Max. 2			General work
87	9	2	2	31,360	7.5	Boiler fittings, etc.
87	8	5	1			Steam valves, etc.
87	7	3	Max. 3			Admiralty Elec. Bronze
86 min.	10-12	2.5 max.	Nil	31,360	10	Air Board (B.2.)
85.3	14.7					Bearing Metal
85	12	1.5	1.5			Axleboxes
85	8	2	5			"Leaded" for pump liners, where resistance to rubbing is required.
85	5	5	5			Plumbing fixtures
84	12	4	....	31,360	3.5	For white metalled railway carriage and wagon axle "brasses"
83	7	6	4			
82	5	8	5			Boiler mountings
80	17.2	....	2.8			Gas meter bearings
80	3	15	2			Oil boxes, etc.
77.5	8.5	....	14			"Plastic bronze" for metallic packing rings
						Properties

It is common practice to add small quantities of nickel to these bronzes to promote soundness.

Table XXII

Cast Aluminum Bronze Properties

(Casting temperatures 1150-1300 degrees Cent.)

	Composition	Per Cent	Yield Point	Ultimate Strength	Elongation on 2 inches	Brinell Hardness	Sp. Gr.
(No. 1)	Copper	90	33,600	77,280	21	104	7.8
	Aluminum	7					
	Iron	3					
(No. 2)	Copper	87	29,120	78,400	15	130	7.6
	Aluminum	10					
	Iron	3					
(No. 3)	Copper	84	52,640	94,080	10	160	7.5
	Aluminum	10					
	Nickel	3.5					
	Iron	1.5					
	Manganese	1.0					
	Silicon	....					

alloys that are cast in his own works.

The works manager of another firm which foresees, and has planned for, a big development for aluminum bronze die castings, sent the author the data in Table XXIII regarding some of the more generally used alloys. Aluminum bronzes also are cast by adding proprietary temper alloys to copper, with the results given in Table XXV.

New Alloy Is Used

A new alloy recently has been introduced in Great Britain, showing exceptional promise in its application to engineering. Certain high duty castings already have been made and approved for British and foreign admiralty work. This proprietary alloy replaces gun metal, to which it has proved to be considerably superior in mechanical properties, ease of pouring, and mechanical stability at elevated temperatures. It is essentially a complex silicon-manganese-copper alloy, containing more than 90 per cent copper, and is thus somewhat lighter, and appreciably cheaper, than ordinary bronze. Data on this alloy are given in Table XXIV.

Before concluding this section of the article, reference should be made to the yellow metals used as solders. Different authorities use different compositions under this heading, as may be seen by compositions shown in Table XX now in use in Great

Brazing solders recently were standardized, as follows in B.E.S.A. Specification No. 263-1926: grade A-copper, 53-55 per cent; zinc, remainder; maximum impurities, 0.50 per cent. Grade B-copper, 49-51 per cent; zinc, remainder; maximum impurities, 0.50 per cent. In these solders tin, antimony, arsenic or bismuth must not exceed 0.05 per cent. Iron is limited to 0.15 per cent maximum and lead to 0.30 per cent maximum.

George M. Demorest, formerly connected with the Robbins Conveying Belt Co., 15 Park row, New York, has been appointed district representative for Pittsburgh and vicinity for the Palmer-Bee Co., Detroit.

Eastern Corp. Organized

The Eastern Corp., New York, has been organized to take over the conveyor business of the Eastern Steel Castings Co., Newark, N. J., and to engage in the manufacture and sale of various types of conveyors together with a general engineering service to the foundry and allied industries.

The company has opened offices in the Graybar building, Lexington avenue, New York, and has secured the manufacturing facilities of a large steel fabricating plant at Hudson, N. Y. This property at Hudson includes a forge shop, a structural steel fabricating shop and a foundry. It is operated by the Gifford Wood Corp., New York.

The officers of the Eastern Corp. are E. F. Miltenberger, president; Benedict Gifford, vice president; and Earl Welborn, secretary-treasurer. The directors are Mr. Miltenberger, Benedict Gifford and W. D. Sargent, president, Eastern Steel Castings, Newark, N. J., and a director of several other companies including the American Brake Shoe & Foundry Co., New York; American Manganese Steel Co., Chicago, and the American Steel Foundries, Chicago.

Other directors of the Eastern Corp. are: Henry F. Otto, Albert T. Otto Co., New York, and A. Thorton Baker, Kelly Converse & Co.

Table XXV

Proprietary Aluminum Bronzes

Copper Per Cent	Temper Alloy Per Cent		Ultimate Strength Pounds/sq. in.	Elongation Per Cent	Brinell Hardness	Sp. Gr.
77	Aluminum, Nickel, Iron, Manganese	23	78,400-98,560	8-15	140-170	7.54
80	Aluminum, Nickel, Iron, Manganese	20	69,440-85,120	8-15	130-150	7.54
80	Aluminum, Iron, Manganese	20	85,120-98,560	5-15	140-170	7.4
80	Aluminum, Iron, Manganese	20	69,440-85,120	15-30	130-150	7.4

Table XXIII

Die Cast Aluminum Bronzes

Copper Per Cent	Aluminum Per Cent	Iron Per Cent	Ultimate Strength Pounds/sq. in.	Elongation Per Cent on 2 inches
90.3	9.7	....	84,976	14
89.6	10.4	....	75,264	23
90.0	8.6	1.4	71,000	42
88.8	9.5	1.6	72,800	23
87.3	10.5	2.2	79,744	13
87.0	10.2	2.8	88,256	12

Table XXIV

Properties of Special Alloys

Sp. Gr. 8.44 — Izod 20 ft. lbs. — Brinell 90-110

	Yield Point Pounds/sq. in.	Ultimate Strength Pounds/sq. in.	Elongation % on 2 inches
Tested at Atmospheric Temperatures	22,400-26,880	40,320-49,280	8-15
Tested at 500° C.	17,000	21,500	16.0

High Quality Steel
Is Produced in
ELECTRIC FURNACES

By Henry D. Phillips

WHILE many methods are used in the manufacture of steel, this article will be limited to the description of a method used to produce plain carbon steel in the acid electric furnace. The metal was used in the manufacture of green sand castings. It is granted by most metallurgists and engineers that acid steel, properly made, is of exceptionally high quality. This statement may be refuted by some, but it generally is agreed that steel which is to be poured into green sand molds, and which sometimes have green sand cores, must be of high quality to produce a casting with any degree of soundness and strength.

Bends Gate 90 Degrees

The procedure described in this article is not the result of an idea or theory that has not been investigated, but is the result of careful work on the subject. The investigation has proved the method to be a success. By this method a 1-inch diameter round gate off a green sand casting has been bent 90 degrees with a sledge hammer. The casting was not annealed. The analysis of the gate was: Carbon, 0.36 per cent; manganese, 0.85 per cent; silicon, 0.46 per cent; sulphur, 0.045 and phosphorus, 0.040. Test bars from heats made by the method and normally annealed passed all specifications. The steel produced is of uniform and high quality.

For fast heats of high grade steel, the charge is calculated to melt at the desired carbon content, so that no time is lost in reducing or boiling out carbon. Immediately after the charge is melted, a carbon test should be taken and if, in the opinion of the melter or by analysis, the carbon is found to be low enough, the deoxidization of the slag, and hence the metal, should begin. It might be wise to state that the carbon content should be a bit lower before proceeding in this practice than in the usual practice, due to the possibility of an increase of carbon during the reducing period.

The slag should be adjusted with a few shovelfuls of lime (oyster shells, fine limestone, or hydrated lime). A few shovelfuls of fine coke dust or breeze (petroleum coke, ordinary coke or charcoal) then should be sprayed over the slag. This must not be added while the bath is boiling heavily, and that the coke must not fall in one place, as this will result in a carbon increase in the first instance and perhaps a reduction of silica (SiO_2) from the slag in the second case.

Describes Practice

MANUFACTURE of acid steel in the electric furnace as described in this article is the practice at the Empire Steel Casting Co., Reading, Pa., where the author is employed. The article gives the general method used in the manipulation of heats, with special emphasis on the deoxidation of the slag and removal of practically all of the ferrous oxide from the slag.

While it generally is accepted that acid slag is more or less self-adjusting, care must be taken that it does not become too low in basic constituents. In such a case, the fusion point of the slag will increase and some silicon will be reduced from the slag in its efforts to adjust itself. At such a stage *snowing* usually will occur. To take care of this, calcium oxide (CaO) and alumina (Al_2O_3) are added to the slag. The calcium oxide is added in any of the forms mentioned and the alumina can be added as fireclay, bauxite or loam. During the deoxidizing period which under normal conditions in a good furnace should not last over 20 or 30 minutes, the slag should be watched carefully to insure the correct reactions.

Too much lime or clay should *not* be added as this will result in slag line cutting of the side walls. If powdered lime is used it should be mixed with a little wet sand to keep it from spraying over and fluxing with the side walls. A few minutes after the deoxidization has begun, a slag test should show a considerably lightened slag color due to the lowering of the iron oxide (FeO) content.

Describes Slag Color

Slag tests after the melt down nearly always will show a black and green color, due to iron oxide (FeO) and manganese oxide (MnO), respectively. After complete deoxidization the slag should show a light cream and green color. During the intervening period, that is, the reducing period, the slag should be changing between these two extremes. The coke added to the slag unites with the oxygen of the basic constituent iron oxide (FeO) reducing it and the iron returns to the bath, thus slightly increasing the yield of the heat.

Since gas, carbon monoxide (CO), is formed at the contact of the slag and bath, the possibility of the metal absorbing a large amount of gas is removed. The more easily reduced oxides of the slag first are removed. The bath is stirred continually, since it is the nature of the electric furnace to keep the bath in a constant state of motion. The oxides dissolved in the metal then are reduced during this period and the deoxidization is nearly complete.

Near the end of the heat, which can be progressing normally so far as temperature goes, a little fine ferromanganese may be sprayed over the slag, to take care of any trace of iron oxide (FeO) remaining. Though not exactly a desirable substance, it is far more desirable than iron oxide (FeO). With the slag the right color, ferrosilicon may be added, if any is needed, and a test for soundness taken. Properly made steel should be

sound and clean. The ferromanganese then can be added and allowed to react for 3 or 4 minutes. A test then is taken and, if all other conditions, such as temperature, ladle, etc., are favorable the heat is tapped. During the last few minutes of the heat, preceding the addition of the ferromanganese, the bath should have a bubbling or churning appearance. This churning of the bath has an exceedingly beneficial effect in removing many minute inclusions in the metal and also in removing carbon monoxide (CO) gas in solution.

It is granted by some authorities that the use of aluminum as a "final deoxidizer" in green sand work is good practice. However, if a green sand with any reasonable permeability and not too high a moisture content is used, the use of aluminum is an indication of poor melting practice. The moisture content of the sand should not be over 3.5 per cent, and should be under the observation of the molding foreman, or sand chemist. The moisture content and permeability of the sand should be given as much attention as the analysis of the metal to be poured into the molds. If a fairly constant check is kept on the sand and the metal is prepared as has been described, the foundryman can feel sure of the high quality of the castings.

Aluminum Is Objectionable

If steel is made properly in the furnace no "final deoxidizer" will be necessary. However, some deoxidizers serve some useful purposes. Aluminum is objectionable because of its deleterious effect upon the ductility of the steel. The minute inclusions of alumina (Al_2O_3) formed by its use, prove harmful to the steel. Ferro-carbon-titanium serves a useful purpose by its ability to remove nitrogen, and also, by its scavenging ability. If it is used, it should be added in the furnace and not in the ladle, due to its high carbon content. It appears the carbon sets up a reaction in the metal while in the ladle. The reaction seems to subside after a reasonably short time but in a steel foundry where metal is wanted fast and hot, it generally is not advisable to hold the ladle full of metal for 5 or 10 minutes for this reaction to die down.

The silicon-aluminum alloys also appear to serve a useful purpose as scavengers and deoxidizers. By forming globules of slag with low specific gravity, they seem to collect other minute slag inclusions in their passage upward through the metal and form a large globule or a conglomeration of small comparatively heavy globules which readily rise to the surface of the steel and purify it. These small inclusions collected around the scavenger seem to be of the nature of silica or alumina; either too heavy or too minute to otherwise slag off.

The hotter the steel desired at tap, the more care should be taken in its manufacture, as the higher the temperature, the greater the solvent power of the steel for its own oxides. Another precaution, relative to adding coke during a boil, is that of stirring the heat immediately after coke has been added and has not been completely burned off.

Experienced Melter Needed

The precautions which have been mentioned, concerning the reduction of silicon from the slag need not be heeded in case it is desired to obtain all the silicon in this manner. However, an extremely competent melter is necessary if the silicon content is desired within certain limits as it is exceptionally hard to judge and control the silicon entering the metal from the slag. It is believed to be better to go half way between and reduce a certain percentage of silicon and add the rest as ferrosilicon. It seems that in reducing all the silicon for the steel from the slag, that more minute inclusions are formed in the metal. However, the nascent or reduced silicon seems to serve a beneficial purpose different from that added as the ferroalloy.

A fallacy in the steel casting industry is that concerning the influence silicon has upon cracks in castings. Silicon does have an effect but it is different than usually supposed. The cracks are due to insufficient allowance for shrinkage or contraction of the metal.

Granting that all precautions have been taken and the heat is ready to tap, the slag should be sound, brittle, glassy, crumble to a powder, and string out from the test spoon or rod. Careful analysis of slags from heats made this way show only a trace of iron in the slag and as high as sixteen and eighteen per cent manganese. These two elements, of course, in an acid slag, are present as silicates. As the heat is tapped a few pounds of ferrosilicon and a bit of lime are added in the ladle. The ferrosilicon is added to take care of any gas entering the metal during tap and the lime aids greatly in the fluxing off the inclusions resulting from the reaction. It might be good practice to add a little ferromanganese in the ladle with the ferrosilicon but it would be objectionable on the same grounds as the ferro-carbon-titanium.

Casts Ice Machinery

(*Concluded from Page* 992)

ley & Piper Co., of Chicago, Ill.

Coke, iron, limestone, sand, and miscellaneous supplies are brought into the transverse bay at the southwest side of the building and are unloaded at both sides of a central track. The sand bins, as previously stated are located on the inner side of this bay. One of these bins has been set apart for the storage of facing material, core binders, wire, nails, etc. Pig iron and scrap is unloaded with a magnet and stored in a number of bins erected close to the wall. Later the craneman transfers this material to a number of inclined chutes facing the track. The men making up the charges spot a scale car towed by a tractor in front of the chutes and pull the pig iron and coke into the charging bucket with long hooks.

The cupolas with charging doors 40 feet above the floor level, probably are the only ones in this country operated in that manner. Each one loaded to the door holds 36 tons. sufficient for the day's run under present conditions. The cupolas were built by the York Ice Machinery Corp., and outside the high charging doors, conform in general characteristics to what may be considered the standard American cupola.

Blast is furnished by a motor driven positive pressure blower made by the Wilbreham-Greene Blower Co., Pottstown, Pa. In this connection it is interesting to note that a small vertical steam engine built by the York Ice Machinery Corp., and employed for many years to drive the blower in the old foundry, has been erected on the mezzanine floor supporting the blowers, where it is held as a spare power unit. These engines formed a regular part of the company's product in the early days before the electric motor attained popularity.

Coke is stored in a large bin elevated 5 feet above the floor level. The bottom of the bin slopes down toward the front where the coke is held in check by a number of small sliding doors. The coke bucket mounted on the scale car is spotted under one of the doors and the coke slides down by gravity, assisted occasionally by a shrewd poke of a long bar in the hands of the attendant. Generous application of this same law of gravity relieves the crane of a great deal of work and enables one operator and one crane to take care of all the lifting in this department. In his spare time the craneman operates a drop ball to break scrap in a space near the south corner of bay.

NATIONAL FOUNDERS
Predict Continued Prosperity

Costs, Selling Problems, and Foundry Production Methods Are Among Subjects Discussed at Annual Meeting

CONTINUED prosperity in the foundry industry was indicated at the thirty-third annual convention of the National Founders' association, Hotel Astor, New York, Nov. 20-21. Few look for activity to be at the high rate of the past year, yet members anticipate good business over the next six months,

T. S. HAMMOND

the recent Wall street crash notwithstanding. The past 12 months were exceptionally good, business being almost if not fully comparable with that of 1926, according to general opinion.

Members also found cause for gratification in progress along lines of safety work, apprenticeship training and other personnel activities. Moreover, under the policy inaugurated at last year's meeting, the association had a satisfactory year both in point of finances and membership. A decline in membership in recent years was checked by a net gain, there now being 476 member companies. The financial position was described as the best in several years.

Foundry costs, the legislative and general financial aspects, selling problems and foundry production methods were subjects of various speakers. The annual dinner was featured by an address by E. H. Sothern, veteran actor, who gave his reminiscences of the stage.

Thomas S. Hammond, Whiting Corp., Harvey, Ill., was re-elected president and S. Wells Utley, Detroit Steel Casting Co., Detroit, was elected vice president; A. E. McClintock was reappointed commissioner, and J. M. Taylor, Chicago, secretary at the closing meeting.

Progress in association activities was outlined in the annual report of President Hammond. He spoke at length upon the improved and satisfactory financial position of the association. He pointed to strides in personnel work, declaring that this work is the determining factor in maintaining efficient labor conditions.

Mr. Hammond outlined the association's attitude on cost work. Due to the varied line of manufacture in which members are employed, it seems impracticable for the National Founders to attempt any extensive cost work, or any sort of a standard or uniform system. It would likely duplicate, and perhaps confuse the work which is done by trade groups to which the members belong. However, the National founders employ a cost specialist to handle all inquiries on this subject, the president stated, and that it was the organization's policy to do all possible to stimulate effective cost work.

Deep interest was manifested in an illustrated paper entitled "Seven Years Foundry Improvement." The paper prepared by D. R. Wilson, chairman of the association's committee on foundry methods and presented by H. K. Lane, Detroit, dealt with improvements at the plant of the Wilson Foundry & Machine Co., Pontiac, Mich., of which Mr. Wilson is president. Charts indicated that within this 7-year period the number of good castings produced monthly had been increased to 571.91 per cent, a gain of 3.61 per cent. The pig bed loss was cut 4.47 per cent to 58 per cent; and foundry scrap from 3.58 per cent to 1.49 per cent. Gates and sprues increased from 16.97 per cent to 20.13 per cent. The increase in the percentage of good castings obtained has been made notwithstanding greatly increased production, it was pointed out. By use of modern methods and carefully chosen mechanical equipment, capacity within seven years has been almost doubled with a relatively small increase in the physical dimensions of the plant.

S. W. UTLEY

The paper described various types of equipment installed and discussed methods employed in various departments. The use of artificial bonding material has greatly cut down the amount of new molding sand required. At present, it was stated, a synthetic molding sand is being used for practically all of the work. This consists of screened core sand treated with a bonding agent and has resulted in reducing the cost per ton of melt for molding sand to 52 cents, a saving of 23 cents a ton. This amounts to a saving of approximately $22,000 a year. Sand control, core baking, the

pouring of molds briquetting and shake-out were all described.

The association's minimum standards for apprentices, prepared last year, have now been generally adopted, according to L. W. Olson, Ohio Brass Co., Mansfield, O., in his committee report on industrial education. This speaker expressed the advantage of a "spirit of agreeableness" in an organization. It is an attitude of mind he said which is the basis of co-operation and which can be handed down through an organization the same as a production order, provided the machinery for so doing is given the same thought. To the worker, he declared, the foreman is the company. The foreman is likely to be his only contact. That foreman's training is of vital importance he said—not training along lines of general education but training on the fundamental principles of human relations and of character building. Frank P. Winans, former president of the Chicago chamber of commerce, and now a member of the brokerage firm of Baker, Winans & Harden, New York, addressed the convention on finance. Attributing the recent break in the stock market in a large measure to the fact that investment demand became saturated beyond all probability of immediate absorption, with new offerings of securities in September alone at the annual rate of something like nineteen billion, the speaker stated that for the present there would likely be a greater interest in bonds. However, he regarded the present situation as merely temporary and that there would be an increasing tendency on the part of the American people to use its savings to participate in the ownership of large enterprises.

To the companies who in the future will depend largely for financing on these securities instead of bonds, Mr. Winans issued a warning. Where an organization has not fixed financial obligations, such as would be the case where they have a funded indebtedness, there is likely to be a letting down in its attitude toward everyday expenditures. Such a development must be constantly guarded against, he asserted.

An informative talk was given by S. Wells Utley, vice president and general manager, Detroit Steel Casting Co., and newly elected vice president of the association. He presented observations made upon the occasion of the International convention of foundrymen in England late last spring, declaring, however, that such observations were tentative, as he believed no one in so short a period as that consumed on this visit could come to positive conclusions.

The great difference between the foundries of Great Britain and this country, he believed, is a social and not a mechanical difference, adding that the class lines in Great Britain place a definite curb on mental initiative and drive. He stated that man for man the Briton probably due to this situation, knew his particular job better than the American but that he had nothing like the all-around experience so often necessary in the training of leaders.

In many respects, Mr. Utley asserted, it was difficult to make an accurate comparison between the foundry industries of this country and of Great Britain because conditions were so entirely different. Mass production, for instance, was difficult in Great Britain because of the physical limitations of the country and the fact that it is an essentially exporting country. Two-thirds of the metal produced in England is shipped abroad where all kinds of requirements are specified. Standardization and in turn mass production are therefore difficult. He cited various other factors, and voiced the American's appreciation of the universal hospitality encountered at the centers visited.

Six Salient Points for Salesmen

IN A CLEVER address on the business of selling, Professors R. C. Borden and Alvin C. Busse, New York University, presented six points in salesmanship evolved from 15,000 case studies extending over a period of seven years. These principles are as follows:

1. During a sales argument don't do more than your share of talking. Let the prospect talk. Be a good listener.

2. Never interrupt a prospect to refute his arguments.

3. Don't slip into belligerence or an argumentative manner.

4. During the opening phase of a sales argument inquire rather than attack. Ask the prospect to explain his objections in detail. He fires his ammunition and will listen later.

5. When a prospect states an objection repeat it briefly, but fully, to show him you understand him.

6. After the preliminaries, base the final attack on one key issue or talking point. Postpone or avoid all other objections.

Business policies and the need for detailed business information were discussed by Roland P. Falkner, chief statistician, National Industrial Conference board, New York. Outlining the development of the various agencies, both governmental and civil for compiling business statistics, the speaker asserted that there is no longer need for business to rest upon rumor, surmise or conjecture. Facts are available for all who are willing to seek them and are able to use them, he declared. Through the multiplication of business journals, governmental bureaus, trade associations and other agencies, the alert business man can profit not only by his own experience but from that of hundreds of others. A breakfast meeting was held Thursday morning at which John L. Carter, Sacks-Barlow Inc., presided. Mr. Carter explained the attitude of the National Founders' association toward the matter of foundry costs. He recognizes the limitations which prevent the National Founders' association from establishing a standard cost system or uniform practices, but holds that the prestige of the organization is pledged to assisting in educational work, in instilling an appreciation of the value of costs and if necessary in providing literature upon the subject for the entire foundry industry. Granville P. Rogers managing director, Steel Founders' Society of America, New York, briefly sketched the previous work which has been done by the steel castings trade association. A system of uniform costs adopted in 1927 has found use in many plants, but has not been universally adopted. A new cost committee of the Steel Founders' society now is studying past and present methods in steel foundry costs.

Walter L. Seelbach, Forest City-Walworth Run Foundries Co., Cleveland, told of the early steps taken by the Gray Iron institute, of which he is president, in studying system as applied to costs. He noted the difficulty of establishing a general system applicable to all classes of gray iron foundries. A fundamental essential of a good cost system, according to Mr. Seelbach, is that it should tie in with the bookkeeping and accounting system and the institute at present is working along these lines.

George L. Morehead, Link-Belt Co., outlined the work which has been

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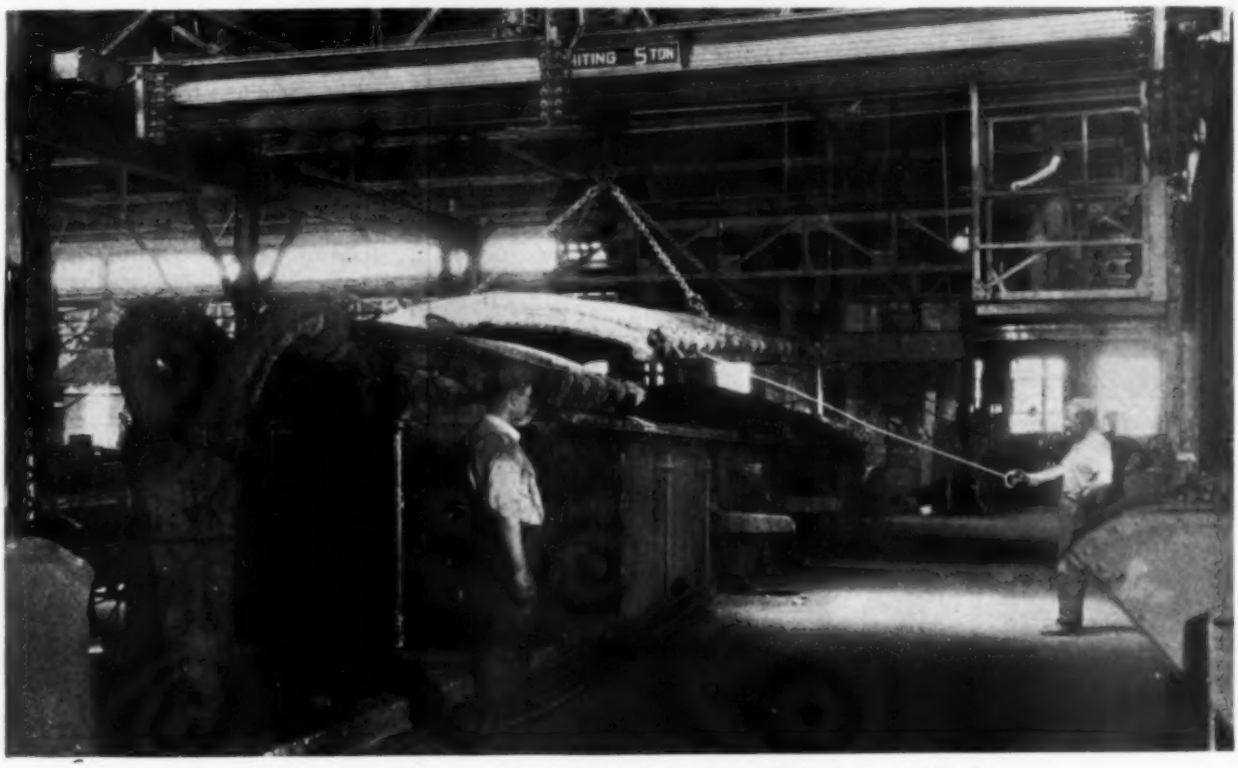


Fig. 1—Powdered Coal Fired Air Furnace With Bungs Lifted

Making Agricultural Implements

By H. Bornstein

IN THE manufacture of agricultural implements in the United States, two classes of castings are used to a large extent. These are gray iron castings and malleable iron castings. Steel and nonferrous castings are used, but in relatively small quantities.

A large tonnage of malleable iron castings is used for agricultural implements. During 1928, about 100,000 tons of malleable castings were used for agricultural implements out of a total of 880,000 tons produced in the United States.

Practically all of the white iron for malleable castings for implements is made in the air furnace. Coal, powdered coal, and fuel oil are the fuels commonly employed. Where coal is used, a low ash, long flame coal, low in sulphur, is desired. Following is a typical analysis of a coal suitable for air furnace work:

	Per cent
Moisture	2.4
Ash	5.7
Volatile combustible matter	36.6
Fixed carbon	55.1
Sulphur	1.1
B. T. U.	13,923

The use of powdered coal is becoming popular and is replacing the old hand firing method. With powdered coal, better fuel efficiency is secured, labor is reduced, the operation is more uniform and a larger tonnage can be secured. There is a considerable range in furnace capacities, but a melt of from 15 to 25 tons is common. Fig. 2 shows a melting furnace of 25 tons capacity using powdered coal as fuel. The pulverizing equipment is in the foreground. Fig. 1 shows the bungs being lifted off the furnace.

The metal charge consists of pig iron, malleable scrap and white iron scrap. A typical charge would be:

	Per cent
Pig iron	38
Malleable scrap	18
White iron scrap	44

The use of powdered coal in melting reduces the time per heat. In one foundry the time per heat with hand firing was 10 hours. This was reduced to 6 hours by the use of pulverized coal. Also, there is less burning out of the elements in the pulverized coal furnace. In the following tabulation the composition of the charge, both for hand firing and for pulverized coal melting, and the

Malleable Is Used

THE manufacture of agricultural implements is an important factor to the foundry industry, since in a great many instances the machines are constructed largely of castings. This article, which is the first of a series of two abstracted from a paper written by H. Bornstein and presented in behalf of the American Foundrymen's association before the recent meeting of the Association Technique de Fonderie de France. Important facts on malleable and chilled iron for agricultural implements are presented in this section. The second section dealing with gray iron will be published in an early issue. Mr. Bornstein is director, testing and research laboratories, Deere & Co., Moline.

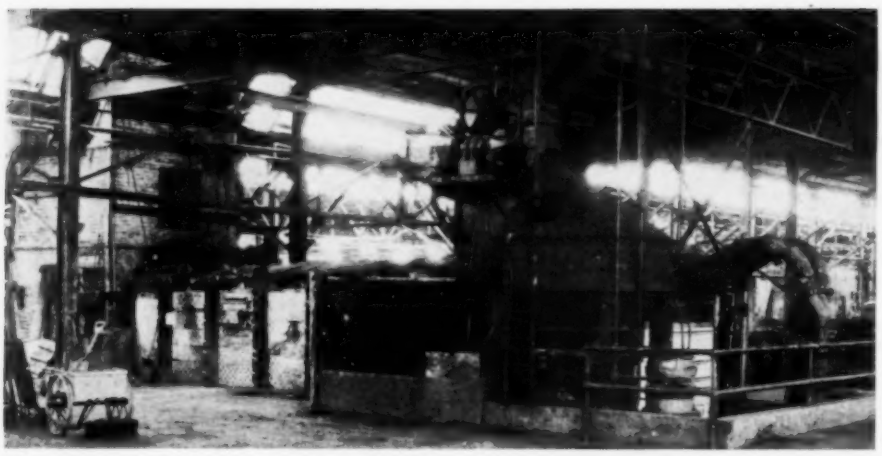


Fig. 2—Crushing Equipment for Coal Is Shown in the Foreground

final analysis of the melt are shown:

	Analysis as charged		
	Hand fired, per cent	Pulverized coal, per cent	Final analysis, per cent
Silicon	1.40	1.35	0.95
Carbon	3.15	2.90	2.40
Manganese	0.50	0.45	0.30
Sulphur	0.05	0.05	0.06
Phosphorus	0.15	0.15	0.15

All of the malleable castings for farm implements are of the *black heart* type. The castings are put through a heat treatment or anneal to change the combined carbon into temper carbon.

Two types of furnaces are used for annealing castings. One is the batch type oven while the other is a continuous oven or tunnel kiln. For both types of ovens, the castings are put into pots which are then placed in the furnace. For the batch type oven a packing material usually is employed. This may be cinders, mill scale, or sand, or a mixture of these materials. In the tunnel kiln, packing usually is not employed.

The tunnel kiln may be gas or oil fired and the temperature control is close. For the batch type oven, the annealing cycle is about eight days as follows:

	Hours
Bringing up to temperature	48
Holding at temperature	50
Cooling	90

The holding temperature is 1525 degrees Fahr., this being the temperature inside the pot in the front end of the oven. Fig. 3 shows the loading of one of the batch type ovens. Near the firing end of the oven the temperature is held not to exceed 1700 degrees Fahr. The cooling through the critical range is at a rate not to exceed 8 degrees Fahr. per hour.

The continuous oven permits of more rapid heating and closer temperature control; consequently the time may be reduced. A six day cycle is common and this may be reduced to five days or less.

Fig. 4—A Mower Shoe Is Made on this Molding Machine

Fig. 3—Loading Castings into the Batch Type Annealing Oven

The castings for agricultural work are small and will average about one pound each. The average per mold will be five pounds and the production of castings per molder per hour will run about 55 pounds.

There is a growing use of molding machines for the production of malleable castings. With the use of

Fig. 5—One Casting Is Made per Flask at the Left, Two at the Right

machines, the production per man is increased and the cost is reduced. Fig. 10 shows equipment used in the molding of a mower shoe. Originally, the job was molded on the bench with a single gated hand pattren in a sand match. This is shown at the left of the photograph. Now the molding is done on a jolt squeeze machine with two patterns in a mold on a cope and drag match plate. See center and right views on the photograph. The direct molding cost has been reduced about 45 per cent, while the molder's earnings have remained about the same. The new method, therefore, results in an

Fig. 8—Two Molding Machine Jobs in a Foundry

Fig. 6—Moldboard Chill with Pattern Laid on and Gate Being Placed

increase of about 75 per cent in production with its attendant savings in overhead. The new method requires a less skilled molder than did the old method. Fig. 4 shows the molding machine and floor on this job.

Fig. 12 shows the pattern equipment used for the making of a harrow tooth clamp. The view at the left shows the hand pattern. There were two gates of ten patterns to a mold. This equipment was replaced by a cope and drag match plate for machine molding with 36 patterns to the mold. The core was eliminated entirely by spreading the jaws and allowing enough draft to make it possible for the pattern to make its own core in green sand. The saving in direct labor was 61 per cent and production on the job was increased 65 per cent. Fig. 9 shows a photograph of the molding machine and floor on this job.

Careful inspection is required of the finished castings to prevent the shipment of castings which are not up to standard. This is particularly

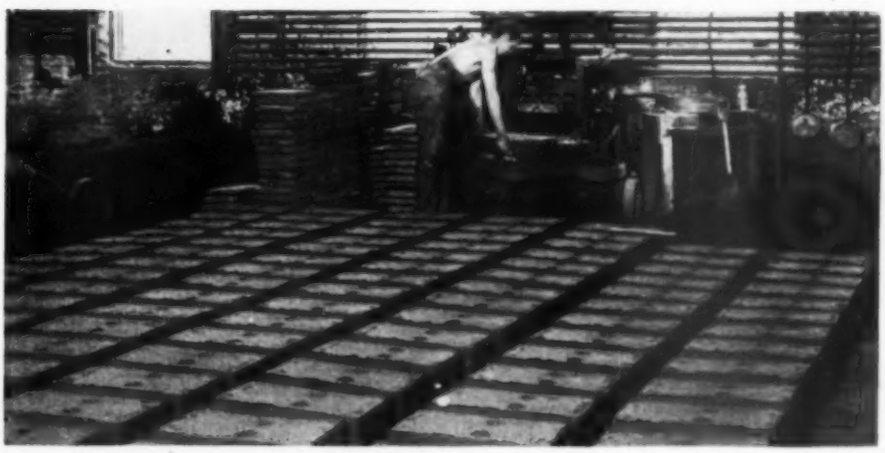
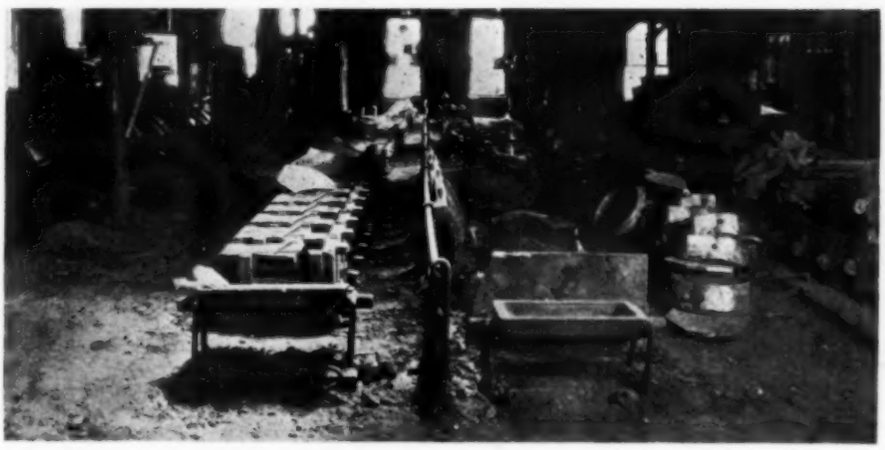


Fig. 9—Molding Machine and Floor for Harrow Tooth Clamp

Fig. 7—A Floor of Moldboards Put Up By One Man



true of castings which are annealed in batch type ovens. It is good practice to have a test casting in each pot. This test casting should be the same type of casting as the balance in the pot and from the same furnace heat of metal. The test casting then is hammered to determine whether or not the material is satisfactory. The ductility of the metal is most important.

Test bars of metal used for malleable castings and annealed with the castings will show a tensile

Fig. 10—Equipment Used in the Molding of a Mower Shoe

strength of over 50,000 pounds per square inch and an elongation of over 15 per cent. The test bar used is that prescribed by the American Society for Testing Materials (Specifications A 47-27) which provides for an unmachined bar having a diameter of ⅝ inch at its smallest section.

For chilled iron plowpoints, a typical analysis is as follows.

	Per cent
Silicon	1.30
Sulphur	0.10
Phosphorus	0.30
Manganese	0.50
Total carbon	3.50

For chilled iron moldboards, a typical analysis would be:

Silicon	0.90
Sulphur	0.11
Phosphorus	0.20
Manganese	0.50
Total carbon	3.65

All of the metal used for plowpoints and moldboards is produced by the cupola process. There is no such thing as a typical charge for the production of these items. This is due to the fact that these parts are manufactured in various locations in the United States, and local conditions govern the use of raw materials. For example, in one part of the country, chilled iron car wheels may be plentiful and the prices low and, consequently, this material would be used. In another part of the country, chilled iron car wheels might be at a premium and, consequently, another form of scrap would be used.

Fig. 8 shows two molding machine jobs at a foundry making plow castings. The view on the right is a landside job, and the one on the left is a plowpoint. This illustration shows the method of stacking, the method of pouring. On each stack a sample of the casting being molded is shown. In the view on the right side of Fig. 8, the job is molded one in a flask, and the molder puts up 255 flasks for a day's work. The total weight of these castings is 1500 pounds. The view on the left side of Fig. 8 shows the plowpoint job poured one in a flask. One man puts up 231 flasks with a total weight of 718 pounds.

Fig. 11—Setting Chill for Hillside Plowshare

Fig. 15 shows two squeeze molding machines. The one on the right has two plowpoints to a flask, showing cope and drag, and the molded job is shown on the left side of Fig. 5. The molding machine shown on the left side of Fig. 15 is one where there is one piece in the flask, and a photograph of the plowpoint as well as of the row of molds is shown on the right side of Fig. 5.

On the left side of Fig. 5, the job shown has two plowpoints per flask and one man produces 192 molds, or 384 plowpoints per day. His production is 1344 pounds. On the right side of Fig. 5, the job shown is one in a flask and one man produces 225 molds with a production of 1350 pounds.

Machines Reduce Cost

Figs. 11, 13, and 14 show views taken in another foundry turning out a similar class of work. The first operation in machine share molding is shown in Fig. 13. The drag is ready for the sand. Setting of the chill for a hillside type of plowshare is shown in Fig. 11. In Fig. 14 is shown a day's work of one man in the making of plowshares. Two hundred thirty-two molds were put up by this man. It may be noted that the method of stacking these molds is different than that employed at the other foundries.

A floor of moldboards is shown in Fig. 7. On this job, one man puts up the entire floor, involving some half dozen pattern changes. The floor consists of 107 moldboards with a weight of 1063 pounds for castings produced.

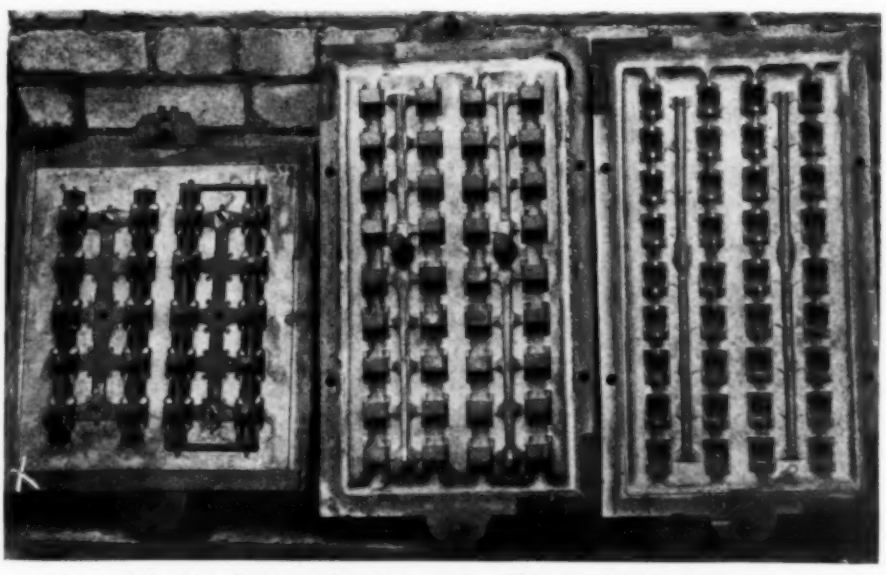


Fig. 12—Pattern Equipment for Harrow Tooth Clamp

A view in another foundry is shown in Fig. 6. At the left is shown the moldboard chill with the pattern laid on and the gate being placed. The mold completed and ready to be closed is shown at the right. Fig. 15 shows a view of two moldboard floors.

Fig. 15—Squeeze Molding Machines for Making Plow Points

Research Association Meets in London

The annual luncheon of the British Cast Iron Research association was held at Hotel Cecil, London, Nov. 6. Following the presidential address, the following officers were elected: President, Major General Sir Philip A. M. Nash, chairman of Metropolitan-Vickers Ltd. Vice presidents, A. W. Steven, McDowall, Steven & Co. Ltd., Falkirk; W. Reavell, Reavell & Co. Ltd., Ipswich; W. Turner MacLellan, the Bengal Iron Co. Ltd., London; John Craig, David Colville & Sons Ltd., Glasgow; Sir William J. Larke, National Federation of Iron & Steel Manufacturers, London.

The following council members also were elected: J. A. Arnott, G. & J. Weir Ltd., Cathcart, Glasgow; A. J. Burn, Llanelly Foundry & Engineering Co. Ltd., Llanelly; J. Cameron, Cameron & Roberton Ltd., Kirkintillock; Major C. Howl, Lee, Howl & Co. Ltd., Tipton; J. Marshall, Staveley Coal & Iron Co. Ltd., Chesterfield; W. B. Parker, British Thomson-Houston Co. Ltd., Rugby; R. O. Patterson, Smith, Patterson & Co. Ltd., Blaydon-on-Tyne; Dr. Walter Rosenhain, National Physical laboratory, Teddington; G. A. Ure, Smith & Wellstood Ltd., Bonnybridge; H. B. Weeks, London; H. C. Dews, Dewrance & Co., London; W. T. Griffiths, the Mond Nickel Co. Ltd., London; W. B. Lake, Lake & Elliot Ltd., Braintree; Wesley Lambert, J. Stone & Co. Ltd., London and president of the Institute of British Foundrymen; D. Wilkinson, Austin Motor Co. Ltd., Birmingham.

Professor D. Hanson, of Birmingham, and W. J. Rees, of Sheffield, were elected honorary members.

Fig. 14—One Man Made the 232 Molds Shown on This Floor. Note Method of Stacking Molds

Fig. 13—First Operation in Machine Share Molding

Gray Iron Institute Has Five New Members

Five additional companies have become members of the Gray Iron institute. They include the Craig Foundry Co., 42 Sanford street, Brooklyn, N. Y., John Craig, president; Steel Drum Accessories Corp., Buffalo, H. M. Lewis, vice president; Dobbie Foundry & Machine Co., 150 Portage road, Niagara Falls, N. Y., Harold M. Richardson, treasurer; Bethlehem Foundry & Machine Co., Bethlehem, Pa., G. Ernest Finck, treasurer; Vulcan Mold & Iron Co., Latrobe, Pa., E. H. Williams, president; and Van Wert Foundry Co., Glenn street Van Wert, O., W. Earl Longwell.

Chain Belt Co., Milwaukee, has opened a New England district office at 950 Park Square building, Boston. J. K. Merwin is district manager.

Questions & Answers on FOUNDRY PRACTICE

THIS department covers all problems relating to metallurgical, melting and molding practice encountered in making steel, malleable-iron and gray-iron castings. Questions submitted by bonafide subscribers to this department will be answered by members of the editorial staff of The Foundry, supplemented where occasion requires by the advisory staff whose personnel is as follows:

John H. Hall—Cast Steel
H. A. Schwartz—Malleable Cast Iron
J. W. Bolton—Gray Cast Iron

All questions should be addressed to The Editor, The Foundry, Penton Building, Cleveland.

MALLEABLE

Small Fittings Shrink

QUESTION

We are having some difficulty with shrinkage in small malleable iron pipe fittings. Can you tell us the causes of such trouble?

ANSWER

While shrinkage some times is caused by the metal, it is unusual if the proper precautions are used in selecting the raw materials and in the melting practice. The tendency of the metal in such case would be to show sluggish characteristics shortly after removing from the furnace, and the appearance, of pinholes in the castings. Due to the relatively high freezing point of white or hard iron used in malleable practice, the mold cavity must be filled as rapidly as possible. Therefore the sprues, runners and gates must be of ample size to fill the mold quickly. Also, sufficient head of metal must be maintained to feed the casting during this short period, otherwise the gate or runner may have a tendency to draw metal from the casting instead of feeding metal to the casting. Gates should be attached to the heavier portions of the castings so that these portions will receive metal as they solidify. If this is not done, the thin sections which freeze first will be solid and the other parts due to insufficient feeding will show shrinks. In some cases, especially with complicated or difficult castings, shrink balls or blind risers close to the castings are used to insure reservoirs of feeding metal. Pouring unfed castings too hot increases shrinkage.

Shallow copes may cause shrinkage due to insufficient head which previously was mentioned. Improper arrangement of patterns on the plate which permits castings to be run or fed from other castings will cause shrinkage. Changing the sprue location to a more central position will give better feeding and eliminate shrinks in castings which previously were farthest from the sprue. If your cope is shallow try using a runner cup several inches high made of green sand over the sprue opening. Also try thickening up the runner and branch gates by removing a little sand with a tool and observing its effect. Possibly greater uniformity of section might help if the thickness is now considerably different at closely contiguous parts.

GENERAL

Charging Not Uniform

QUESTION

In my cupola lined to 48 inches I place 2200 pounds of coke on the bed. The first iron charge consists of 5000 pounds and after that I place two 3000-pound iron charges and two 450-pound coke charges. The remainder of the charge is made up of alternate charges of coke and iron in the proportion of 3600 pounds of iron to 400 pounds of coke. The first charge of iron melts fairly hot, but the second and third charges are cold and then the iron gets hot again and remains hot for the remainder of the heat. I have tried both increasing and decreasing the quantity of coke on the second and third charges with a view of preventing cold iron but without success. Will you kindly point out the cause of the trouble?

ANSWER

The erratic manner in which you proportion the bed charge and the two succeeding charges is responsible for cold iron during the first part of the heat. Make all your charges uniform and if you observe the other features incident to good cupola practice you will secure hot iron from the first to the last heat. Assuming that your bed is the correct height when melting commences, it will have burned down beyond a safe distance before the first heavy charge of 5000 pounds of iron is melted. The following excess charge of coke raises the bed part way to its original height and the second charge places it at the correct height for melting where subsequent charges maintain it for the remainder of the day's operation.

Iron melts at a definite height above the tuyeres and any manipulation of the charges above or below that point will result in cold iron. The statement that your coke bed weighs 2200 pounds does not convey any information on which to base an opinion since you do not give the height of the tuyeres. For example 1000 pounds of coke might form a satisfactory bed where the tuyeres only are 4 inches above the sand bottom, whereas 2000 pounds might be necessary where the tuyeres are 12 inches above the bottom.

The quality of the coke, the relative proportion of pig iron and scrap, the length of time the cupola is in blast, and the class of castings to be poured, determine to quite an extent, the most suitable weight of iron to place in each charge.

Since you seem to find that 3600-pound charges melt satisfactorily, it may be well to continue on that weight, but you will get hotter iron, a cleaner furnace, and faster melting by using 3000 pounds of iron to 300

pounds of coke. See that the bed is thoroughly burned through and that the furnace is hot before adding the final 4 inches of coke that precedes the first charge of iron. Also see that the coke extends to a point about 30 inches above the tuyeres, just before the iron is charged. Coke settles to an alarming extent during the first hour after it has been ignited and many foundrymen who assure themselves that the coke is 30 inches above the tuyeres half an hour before charging begins, would be astonished if they viewed the same bed immediately before the first iron is thrown in.

Q & A

Machine Loss Is Heavy

QUESTION

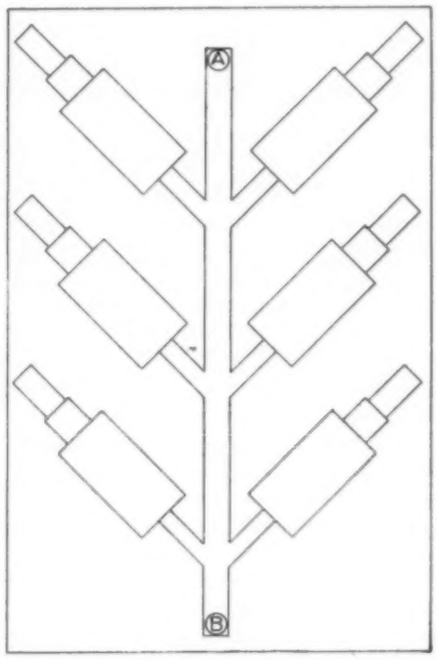
We are enclosing sketch of a small, gray-iron, solid, cylindrical casting 5¼ inches long, 1¾ inches diameter at large end and ¾-inch diameter at small end. These castings must be perfectly clean and solid. They are machined all over. Our machine shop loss on these castings is excessive and we shall appreciate your suggestion on how to cast them properly, particularly any special system of gating that may be necessary to insure perfect castings.

ANSWER

If you had forwarded a casting instead of the sketch we should be in a better position to diagnose the cause of the trouble and to suggest a remedy. Offhand we should say the casting is so plain and simple that no difficulty should be experienced in securing good castings irrespective of the manner in which the mold is gated. Assuming that the defective castings are rejected on account of blowholes or dirty areas, these defects may be due to melting conditions, hard or wet sand, too many patterns crowded into a flask, negligence in skimming the ladle, loose sand around the pouring sprue, slovenly workmanship, or prodigal use of the swab. Any or all these elements may be present and nothing short of actual observation can determine which factor or factors actually are the cause of the defect.

The best method to adopt in making the molds and gating them depends on circumstances. Manifestly flask, pattern and machine equipment that would be perfectly justifiable on orders running into the hundreds of thousands, would be entirely out of place if the extent of the order was limited to a small number. Elaborate equipment would turn out an immense quantity in a short time, but as stated previously, practically any method of molding and gating should produce clean castings, if ordinary precautions are observed.

One typical method out of many that might be submitted is shown in the accompanying sketch, which simply is approximate and is not drawn to scale. Split wood or metal patterns are mounted on a match board or plate in such a manner in relation to the center line that cope and drag in succession may be rammed on the same board or plate. This layout may be varied to a slight extent and adapted to fit any one of various types of machines. For example some machines are equipped to ram cope and drag at one time, either on top of each other with a pattern plate between, or, side by side on two plates attached to the machine's platen.



THIS TYPE GATE INSURES CLEAN CASTINGS BY TRAPPING ANY DIRT

A still simpler layout, one in which the patternmaking expense is reduced to a minimum consists of half a dozen solid patterns and a follow board. The patterns easily are turned in the lathe and the follow board is made from sand, plaster or one of the proprietary materials now available for the purpose.

The style of gate shown in the accompanying sketch is recommended as an insurance feature to catch and hold any dirt that may enter the runner with the metal, or any loose sand that may be lying around the pouring basin or runner. The stream of iron will carry all the dirt from the entrance point *A* to the outlet *B*. There it will remain floating while the gate fills and the iron gently rises or backs up into the several mold cavities in which the casting forms.

Without actual knowledge of conditions, but basing our opinion on somewhat similar instance, we are inclined to the opinion that your trouble is due to the fact that the molder uses the swab too freely on the shoulders of sand in the mold. A second possible reason is that the cope may be too shallow or the molder *cuts* the stream before the runner is filled to the top. The head should be filled to a depth at least 4 inches higher than the castings. With the iron you are using the castings will shrink under a low head.

Another far fetched reason occurs to us and that is you may be molding and casting these castings on end. Certainly they may be molded in that position, but if they are placed too close together, the amount of steam generated will be above normal and the result will be a set of castings filled with bowholes. The obvious remedy for this condition is to space the patterns further apart and if necessary use the vent wire in the sand between them. Also employ either a perforated bottom board or leave space between the bottom board and the edge of the drag for the steam to escape readily.

STEEL

Patterns for Steel

QUESTION

What shrinkage should be allowed when a jobbing pattern shop receives a blueprint for a steel casting when the patternmaker does not know where the casting is to be poured, or whether it is to be made in a green sand or a dry sand mold. Is there any standard custom among patternmakers in this respect, or is there a recognized shrinkage measurement generally followed?

ANSWER

The standard shrink rule universally used by patternmakers in laying out patterns for steel castings allows for a shrinkage of ¼-inch per foot. Under ordinary conditions a pattern constructed according to these measurements will yield a casting of the required dimensions. However many factors may interfere with a consistent and universal shrinkage. The shape of the casting, the presence of cores, the position of the gates, and the character of the sand, green or dry, in which it is molded, all must be taken into account. An extremely long casting will not shrink the full amount. Large cores or hard cores will prevent a full shrinkage. A green sand mold will yield more readily than a dry sand mold and will allow a fuller shrinkage. On light, thin castings a misplaced gate may retard the shrinkage at that point. In some instances it is necessary to *ease* the

mold shortly after the casting is poured. If this precaution is omitted, in some instances the casting will crack, while in others the casting may not crack but it will not contract normally. Occasionally a freak casting will contract the anticipated distance longitudinally, but will not contract the full distance transversely. Manifestly these various factors are more familiar to the foundryman, than they are to the patternmaker and it is clearly within his province to instruct the patternmaker to make the necessary adjustments in his standard measurements. Technically, the claim may be advanced that the patternmaker should make a pattern that will yield a casting of certain specified dimensions, but, since he has no control of subsequent foundry operations, he is justified in making it according to his standard ¼-inch-to-the-foot shrink rule. Instances sometimes appear where the pattern is made correctly, the casting shrinks normally, but still it is over size. This is due to a weakness in the mold or the flask which strains under the pressure of the metal. The casting swells beyond the anticipated bounds while in the liquid state and naturally this condition is perpetuated in the cold casting.

GRAY IRON

Equipment Reduces Cost

QUESTION

We are forwarding for your inspection a small gray iron casting and will appreciate your advice on how to reduce our operating cost in the production of these castings in considerable quantity. We use an aluminum matchplate containing six patterns and make the molds in a snap flask 12 x 20 inches; 3¼-inch cope; 2¼-inch drag with a reinforcing band in the drag. The daily average output for each molder is 110 flasks. We are quite satisfied with the number of molds, but they occupy too much floor space and involve too much labor in pouring off. Two men carry iron to the floor, two molders pour from each end of the floor and two helpers shift the weights. Is it practical to stack the molds and pour them with a large ladle? Can you suggest a method by which the labor and floor space may be reduced?

ANSWER

The idea of stacking the molds is quite feasible, but its adoption will involve a little different pattern equipment from that which you are using at present. If your patterns were flat on top they would serve either for single or stacked molds, but since part of the pattern projects into the cope, you will have to arrange a pattern that will produce a cope and drag impression in each section of the flask. If you are familiar with the details of molding practice we do not need to go any farther, but if not we suggest that you get in touch with one of the molding machine manufacturers in your vicinity who will give you a practical demonstration of the principle of multiple molding which may be applied to your case.

Installation of a monorail and ladle pouring device will enable you to reduce your pouring gang by from 50 to 75 per cent. With one man to handle the mixing ladle at the spout, a second man can handle a pouring ladle of from 100 to 500 pounds capacity and a third man can shift the weights. You can find the addresses of the pouring device manufacturers in the advertising section of THE FOUNDRY.

Q & A

Semisteel Not Used

QUESTION

We melt from 40 to 45 tons of iron per day in a 60-inch cupola and pour it into stove plate and sanitary ware castings. We should like to use steel scrap in the mixture, but do not know whether the resulting metal would be suitable for our work. If the method is feasible will you kindly indicate the amount of each component element required to make up a charge for our cupola.

ANSWER

It is not customary in this country to add steel scrap to the charge required for stoveplate and sanitary ware. The only exception so far as we know is where a malleable iron is made in the cupola and where the castings afterward are annealed.

One of the reasons why steel is not employed is because cast iron scrap is comparatively cheap and plentiful. Another reason is that close supervision is required to maintain a uniform product where steel forms part of the charge. The objection advanced at times by foundrymen who are opposed to its use that steel renders the iron less fluid and also that it produces hard castings is disproved by the practice in automobile casting shops, where an average content of 20 per cent steel is added to the iron. The walls of some automobile engine castings are as thin as stoveplate and cast-iron sanitary ware and yet the castings are made quite successfully.

One point to be remembered is that as the percentage of steel increases the silicon content of the accompanying pig iron must be increased proportionally. Steel scrap contains no silicon. We should suggest that you first try a 10 per cent steel mixture and gradually increase the amount of steel as conditions may seem to warrant. To insure exceedingly hot metal and at least 2.00 per cent silicon in the castings, the charges will be made up in 2000-pound lots arranged as follows: 800 pounds pig iron, 3.25 per cent silicon; 800 pounds scrap, 2.00 per cent silicon; 200 pounds steel, no silicon.

Q & A

Wants Hard Iron Castings

QUESTION

Can you advise us how to make extremely hard iron castings? We desire castings as hard as can be made to withstand wear in grinding. It will not be necessary to machine the castings, but they must be hard.

ANSWER

The following mixtures are excellent for making grinder disks such as used for small mills:

Mixture No. 1

Per cent in Charge	Material	Sil.
50	Malleable Bessemer Pig	1.00
50	Return White Iron Scrap	0.75

Mixture No. 2

50	Malleable Bessemer Pig	1.00
15	Gray Iron Scrap	2.00
20	Return White Iron Scrap	0.75
15	Steel Scrap	0.05

Since steel scrap is used in the second mixture, a mixing ladle will have to be used at the cupola spout to insure a uniform mixture. Otherwise part of the iron may be gray and the other white. Also since you have no machining you may increase the steel scrap up to 25 per cent. Use plenty of coke and get the iron hot. This is essential in making good semisteel castings, especially those low in silicon.

Q & A

Castings Resist Heat

QUESTION

Is there anything that we can add to our iron to make it hard and more resistant to heat? This iron is to be used for grate bars.

ANSWER

At present many foundrymen making grate bars claim that they are obtaining excellent results by the addition of nickel and chromium to their mixtures. One composition is given as containing 1.10 per cent silicon, 0.50 per cent chromium and 0.95 per cent nickel. The nickel and chromium may be added to the ladle as ferrochromium and nickel shot, an alloy of nickel and chromium or in the cupola charge in the form of a nickel-chromium bearing pig iron.

Some foundrymen use a mixture that will give a mottled structure midway between gray and white cast iron which gives good results.

Problems in Nonferrous Founding

By Charles Vickers

Castings Fail To Run

We are experiencing considerable trouble in casting basin cocks, our loss being about 10 per cent on that job. We enclose a sketch of how the patterns are gated and in addition we are forwarding a sample bad casting. We use flasks 12 x 18 inches; cope 3 inches, drag 2 inches deep respectively and we arrange 5 castings on a gate. The molds are made on a molding machine and are squeezed just hard enough to prevent swelling and drop-outs. A fairly open sand is used, and the cores are made of white sand bonded with linseed oil 45 to 1. The runner is ¾-inch wide by ½-inch thick and the sprue is located at one end and is 1½ inches in diameter. We melt in a barrel type furnace with oil at 15 pounds pressure and air at 4½ pounds.

The furnace we use has 600 pounds capacity but we only charge it to 500 pounds. In pouring off, we use graphite crucibles, made red hot, and only take 75 pounds of metal to pour 10 molds. The molds are poured hard, the sprue being choked full right from the start. A light grade of fuel oil is used to melt with. We use ingot metal made from cheap yellow brass scrap. We do not add any tin, lead or zinc, nothing but 2 ounces of yellow phosphorus just before pouring. Borax is used as a flux when the furnace is charged and we put in the 500 pounds all at one time. The furnace is run from 2½ to 3 hours, but the metal is thick and sluggish. Do you think that this is time enough? Any suggestions that will enable us to reduce our loss will be appreciated.

The sample casting has failed to run at the tip of the spout and that is all that fault that we can find with it, considering the character of the metal used. Nothing is mentioned about leakers in the letter, therefore it can be assumed the source of the loss is in misruns, and this is what we are to consider mainly. Whether these flasks are poured on the level or are inclined from the sprue end, the metal has to run uphill to fill the spout. The fifth casting at the bottom of the runner, or the end farthest from the sprue has the spout more severely inclined upward than any of the others. Has any study ever been made to determine whether or not, most of the defectives came from this pattern?

If the molds are poured flat, this impression would get a poor distribution of metal as compared with the others, this means more bad castings. We suggest this pattern be changed in such a way the metal has a better chance to fill the spout end of the cock where the metal thickness is thinner than elsewhere. We suppose the runner is entirely in the drag for such usually is the case with this type of gating.

A runner so placed will do no feeding to the gates and thence to the castings. On the contrary it will bleed the gates if anything. Theoretically the castings should be heavy leakers, but faced as we are with a loss of only 10 per cent presumably from all sources, and considering the metal itself we feel that the foundryman should be commended for doing as well as he is doing.

It is always advisable in gating brass, yellow or red, to use a runner in both cope and drag; two-thirds in the cope and one-third in the drag, and to choke the gates right at the point of juncture with the castings. The gate itself should be made double as well as the runner. This allows the sprue head to be filled at start of pouring as is done at the present in this case. This is necessary with yellow brass. The comparatively thin section of gate at the choke is kept open by the mass of metal behind in the gates and runner, and by the casting itself, so it does all the feeding required. The metal in the furnace should be (for yellow brass) hot enough to flare strongly, and in the carrying-off crucible at mold side it should flare quickly when disturbed by the skimmer. It should be poured as near this temperature as possible.

If the metal does not get as hot as this you should check your furnace practice to see that you are melting rapidly and efficiently.

Should Use Good Metal

We desire to obtain a brass mixture suitable for hydrant valves and other fittings, and we would like it to be half copper and half scrap red brass. We also would like a mixture for the hydrant stems or screws. We might have to cast the latter out of new red metal; though we are inclined to think scrap metal will do. These are for fire hydrants and we do not believe the castings have to withstand more than 80 pounds pressure.

Fire hydrants ought to be made out of nothing but the highest grade materials, both the nonferrous and the cast iron parts, and responsible manufacturers of such equipment are particular in this respect. It will be easily understood that failure of any part of a hydrant at the moment of being put into service might mean the loss of considerable money because of the headway the fire obtains due to delay. The stems usually are cast of aluminum bronze which contains copper, 86 per cent; iron, 4 per cent, and aluminum 10 per cent. Each heat is expected to have around 80,000 pounds per square inch tensile.

What is wanted is a stiff metal, so the threads on the stem will not distort when the fireman puts a length of gas pipe on his wrench as may occasionally happen when the valve sticks. Manganese bronze of high tensile is also used for such stems.

For the red metal the following alloy should be used: 87 per cent copper; 7 per cent tin; 3 per cent zinc, and 3 per cent lead. It may be satisfactory to use 50 per cent of new metal, and 50 per cent of scrap metal provided the composition of the scrap is known. If it is unknown and is a jumble of old brass the resulting mixture will be uncertain, and never twice alike. The only way to use scrap metal is to have an expert sort it. Then, get analyses of the different mixtures and proportion them, so that a mixture may be made that will approximate a formula such as the red metal mixture given here.

MELTS *Bronze* in the Cupola

Fig. 1—The Tuyere Extensions Are Provided with Shutters by Which the Volume of Air May Be Regulated When Natural Draft Is Utilized.

ALTHOUGH the cupola never has been recognized as a regular medium for melting nonferrous metal, still it has been pressed into service on many occasions where the general jobbing foundryman has found a job on his hands too large for his usual nonferrous melting equipment. Marine foundries, perhaps more in the past than in the present, have been forced by circumstances to adapt cupola melting conditions to suit either bronze or gray iron. Metal for many bronze propellers has been melted in the old-time, general jobbing, gray-iron foundry equipped with a 30 to 40-inch cupola.

Metal May Be Melted

An interesting description of two prominent foundries in which the cupola is utilized for melting bronze and copper appeared in THE FOUNDRY Dec. 1, 1924 and Jan. 15, 1926. Once a year on the average on the page devoted to "Problems in Nonferrous Foundry", Charles Vickers advises a doubting correspondent that bronze may be melted in the cupola provided the melter observes due precaution. The most essential feature is a mild blast, approximately one third of that employed when melting gray iron.

The idea of combining this low blast feature with a special type of fuel led Daniel Cushing, Lowell, Mass., to develop the type of cupola shown in the accompanying illustrations.

Fig. 2 is an elevation and Fig. 3 is a plan view partly in section of the first cupola 18 inches in diameter designed and built for this specific purpose. Fig. 1 shows a larger size, 30 inches inside diameter.

Gray iron melting practice is not suitable for nonferrous metals. Copper and its alloys absorb sulphur from ordinary coke. The heavy air blast causes the formation of metallic oxides which combine with the sulphur to form blowholes in the resulting castings. Slag from the necessary fluxing of the ash is objectionable. Variation in the quality, physical properties and chemical composition of the fuels usually employed in the cupola introduce further complications in maintaining a uniform product. Some nonferrous metals, particularly those containing zinc, suffer severe loss from volatilization when melted in direct contact with the fuel as in a cupola.

Claims for the success of the new cupola are based to a great extent on the use of a coke made by coking coal tar pitch in a beehive oven. It is claimed this coke is of a character and structure amply sufficient to carry the burden in a cupola. It is strong enough to carry the load, contains from 98 to 99 per cent fixed carbon, is said to be substantially free from sulphur and ash, carries no phosphorus and is capable of liberating about 14,500 B.t.u. per pound.

The cupola substantially is the same as that now in use where layers of metal and coke alternate and where combustion is maintained by the introduction of air through a number of openings or tuyeres located near the bottom of the furnace. By resisting the amount of air it is claimed that sufficient combustion may be maintained to melt the metal under a reducing atmosphere that prevents oxidation of the metal. The high thermal value of the fuel prevents the metal from freezing where this low blast is employed. The molten metal is withdrawn from the cupola and handled subsequently in the manner usually practiced in gray iron foundries.

For convenience in reference the various parts of a typical furnace shown in elevation and plan respectively in Figs. 2 and 3 are numbered as follows: 1, is a cupola that may be mounted on a base or frame, 2, by the hollow projections, 3. These hollow projections serve as tuyeres connected by a branched blast pipe, 4, to a blower, 5. A valve, 7, is provided for regulating the blast and a gage, 8, measures the pressure. Plugs, 10, in the branches, 6, may be removed to utilize natural draft upon occasion.

Explains Construction

The bottom, 11, is covered with refractory material, fire brick or sand. The shell of the cupola is lined with fire brick in the usual manner. This also means it may be lined with special shaped refractory blocks or with a monolithic lining capable of resisting the melting temperatures of nonferrous metals.

A housing, 13, surrounds the upper end of the cupola and leads to a stack, 14, to which it is connected through a slip joint, 15, so that the housing may be raised when it becomes necessary to swing the cupola into a horizontal position for relining. Materials are charged into the cupola through the doorway, 16. Counterweights, 17, facilitate raising the housing. The tap hole, 18, and spout, 19, are shown near the bottom of the cupola at one side while a slag hole, 20, and slag spout, 21, are shown at the opposite side and at

a slightly higher point in the shell.

With the exception that a lower coke bed than usual is employed, the method of charging the cupola under discussion is similar to that usually employed in gray iron foundries. A thin layer of the special coke is placed on the bottom and ignited. Additional coke then is added gradually until it extends to a point about 12 inches above the tuyeres. The coke may be ignited in any convenient manner, but preferably by a torch. Tap hole and slag hole are left open until the time comes to charge the metal.

After the bottom of the cupola has become highly heated in this manner all the openings are closed and alternate layers of coke and metal are placed in the cupola. This applies in situations where a uniform product is required. Where several different mixtures are needed, it has been found advisable to charge and tap each one separately.

Blast Pressure Is Low

The pressure and volume of blast supplied through the tuyeres only amount to approximately one third of those employed in melting iron in a cupola of the same given dimensions. Apparently only sufficient air is required to supply combustion of the coke without oxidizing the metal. Thus in the 18-inch diameter cupola shown in Fig. 2, an air pressure of 2 to 4 ounces is sufficient. Bronze melts about 3 minutes after the blast is applied and copper melts a minute or two later. Under favorable conditions the natural draft of the stack is sufficient to melt the metal. Air at normal pressure is admitted through the openings, 9, shown in Fig. 3.

This idea has been elaborated and improved in the cupola shown in Fig. 1, which is 30 inches diameter inside and is equipped with four tuyeres. The tuyere opening through the lining is only 3 x 4 inches, but each tuyere casting on the outside of the shell is 10 inches in diameter and 12 inches in length. The outer end contains four radial openings and these in turn may be fully closed or opened, or maintained at any stage between, by a revolving shutter. In this manner the volume of natural draft may be adjusted nicely to meet special conditions.

Claims set up for the foregoing method of melting nonferrous metals include, a lower fuel consumption than is possible with any other, faster melting time, and all the gases escape up the stack instead of contaminating the air inside the foundry.

Shape and size of the metal to be melted is said to be immaterial. The low blast pressure it is claimed permits the melting of borings, turnings and other fine material. Large sizes are limited only by the size of the charging door opening, according to the firm which has developed this type of cupola and method of melting.

Discusses Electric Heat in Industry

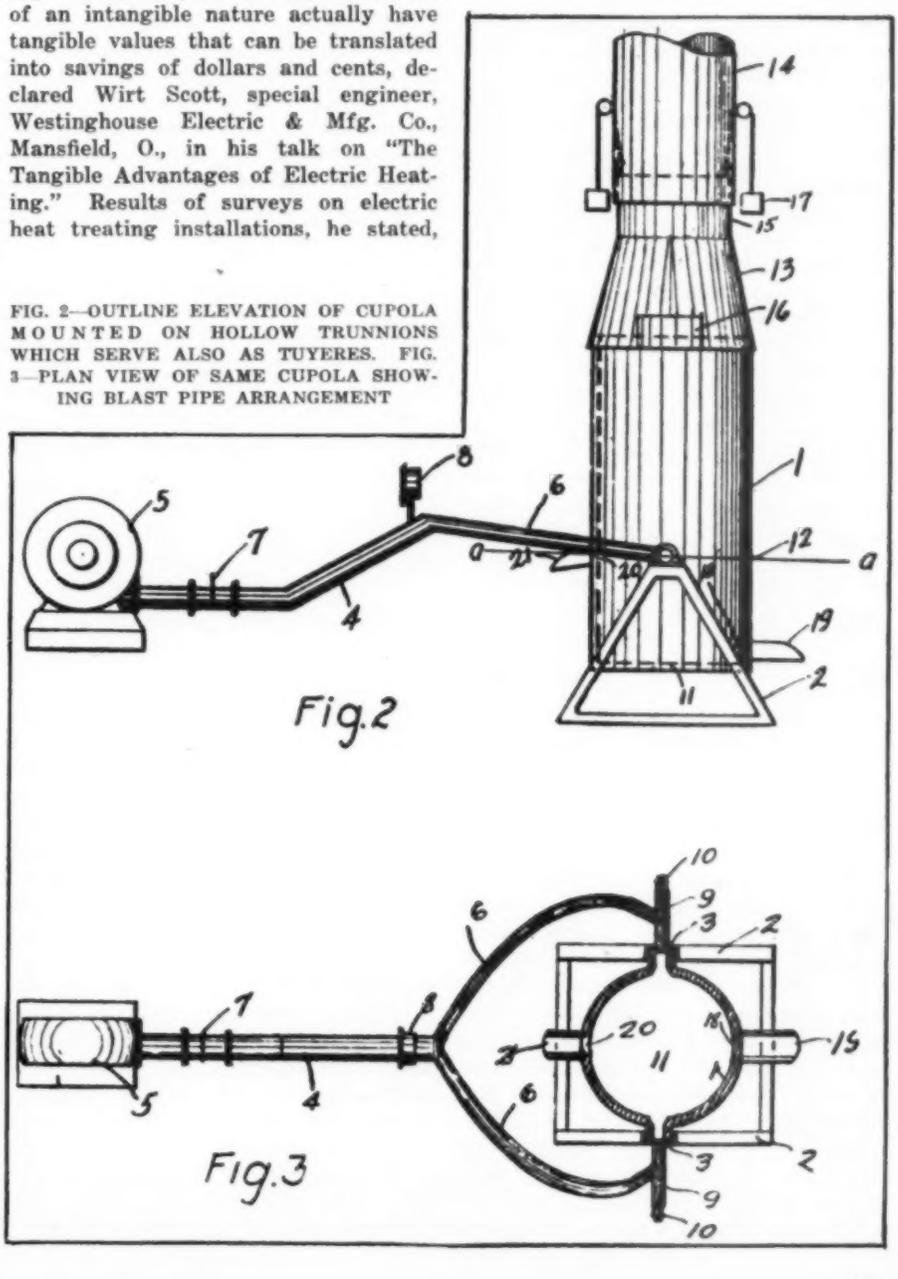
Recent developments in the use of electricity for heating provided the subject for considerable discussion at the third annual electric heating and welding conference held in Pittsburgh Nov. 13 and 14 under the auspices of Pennsylvania State college and the Association of Iron and Steel Electrical Engineers.

Advantages in use of electric heating that usually have been considered of an intangible nature actually have tangible values that can be translated into savings of dollars and cents, declared Wirt Scott, special engineer, Westinghouse Electric & Mfg. Co., Mansfield, O., in his talk on "The Tangible Advantages of Electric Heating." Results of surveys on electric heat treating installations, he stated, form a basis for ascribing approximate savings on the various advantages inherent in this type of equipment.

James Kniveton, Ryan, Scully & Co., Philadelphia, spoke on "The Electric Annealing Furnace," pointing out the advantages of uniform heat distribution and accurate temperature control of this type of equipment. The small box and continuous types of furnaces are particularly adaptable to electric heat. He mentioned that refractories play an important part in the efficiency of the furnace.

Various types of steel melting furnaces were described by Frank W. Brooks, chief engineer, William Swindell & Bros., Pittsburgh, at Thursday morning's session. Mr. Brooks discussed briefly the development in steel melting furnaces from the time of the crucible type down through the period when the bessemer was in vogue to

FIG. 2—OUTLINE ELEVATION OF CUPOLA MOUNTED ON HOLLOW TRUNNIONS WHICH SERVE ALSO AS TUYERES. FIG. 3—PLAN VIEW OF SAME CUPOLA SHOWING BLAST PIPE ARRANGEMENT



the present open-hearth and electric furnaces. Production of electric steel for use in making steel castings, he pointed out, has increased from 0.01 to 25 per cent of the total during the past 20 years. The direct arc and indirect arc resistance furnaces were the types principally described, although the core type and coreless type of induction furnaces also were discussed. The use of the automatic regulator in raising and lowering of the carbon electrodes in the direct arc resistance furnace is one of the most important developments in this field.

Advantages of obtaining uniform heating and closely regulated temperatures were emphasized by A. E. Bellis, president, Bellis Heat Treating Co., Branford, Conn., in his talk on "Electric Salt Bath Furnaces." Chemistry, metallurgy and electrical engineering all enter into the subject of providing a satisfactory electric salt bath furnace. The obtaining of the correct temperature in the bath is more important than the rates of heating or cooling, Mr. Bellis declared.

The conference was concluded with a dinner Thursday evening in the William Penn hotel. Lieut. Commander C. E. Rosendahl, United States navy, the principal speaker, related his engineering impressions and experiences aboard the Graf Zeppelin on its flight around the world.

Tests Show Fire Brick Properties

By Frederic B. Stevens

TO ANY question or problem, the solution of which is obvious, we immediately supply the answer and defend a possible doubt, by saying, "That is common sense." Uncommon sense is that which is not so evident until it is first revealed. It would be, merely, the exercise of common sense to say that a fire brick that is stamped No. 1 by the manufacturer is first in quality. This might be true of that specific type of fire brick when used within limitations and for those purposes for which it is intended. That same fire brick might register No. 10 when relatively compared with other types or kinds which are made for other purposes.

To determine the relative practical values the cone test is sometimes applied, for two fire brick may look as near alike as two peas in the same pod and yet be wholly unlike when in actual service. There are manufacturing chemists whose laboratories develop, for tests, cone shaped units, each containing different proportions of silica and alumina, the two important elements of fire clays. The seger cone is in general use and was approved by the United States bureau of standards. These cones are made in series with various fusing points, say, from 2000 to 3200 degrees Fahr.

To test a fire brick it is placed in a testing furnace, where gas or oil fuel is used, with several of these cones and with their fusing points ranging from 2000 to 3200 degrees Fahr. The cones are watched as the heat is advanced and when the conical point of a cone begins to soften and sag, the limit of its heat resistance is thus determined. Should the fire brick show similar effect, its heat resistance is registered as that of the cone, say, for example, at 2000 degrees Fahr.

Thus, uncommon sense is the knowledge which is not apparent until it is discovered.

The test of that specific kind of fire brick insures its safe use where it is to be subjected to only low degrees of heat. For example: for side and back walls of household mantel grates for open fires; for firebox linings for the stationary, hand-fed steam heating boiler, and for similar uses. That same kind of fire brick would be resolved into a soft melted mass when tested with a cone made to resist 3200 degrees Fahr.

A fire brick that will resist such a test of 3200 degrees Fahr. is called a *high-grade* fire brick and may be used safely in open-hearth checkers, in blast furnaces, soaking pits, forges, and for some boiler settings where extreme heats are developed and where high temperatures must be maintained. Under some steam boilers a temperature of 2600 degrees is reached and the fire-box walls must resist not only the heat but also the abrasion wear of the slicing-bar of the fireman when he attempts to dislodge clinkers. The fire brick arch of the malleable iron air furnace contends not only with cutting flames but also with white heat, while the foundry cupola brick lining meets a lower degree of heat but it must resist the wearing process of the load, composed both of pig iron and the irregular shaped and sharp edges of scrap iron, as that mass moves downward during the melting process.

A genial soul called at my office, one morning, and laconically announced he had "the world by the tail," for he was promulgating a fire brick that had withstood a test of 4000 degrees Fahr. and when that brick was red hot, it was, he said, thrown into a pailful of cold water but it did not crack, shatter, or break; —"it only sissed." I asked him if it was the brick or the water that "sissed." He did not know. Chemists, who know, assert that there are no fire clays, found in this country, that have a fusion point higher than 3200 to 3300 degrees Fahr.

There are certain fire brick for special purposes that contain magnesite, or chrome or the diaspore containing 70 per cent aluminum oxide, but obviously these are of another family. I, accordingly, inquired of my quondam friend if his wonder brick was all fire clay or if he had introduced some foreign element. He replied "not very foreign, just every day, common wood sawdust."

It is a theory, if not a fact, that a coarse grained fire brick will resist better the expansion and contraction effects of heat and cold than one of finer grain and of more compact structure. Thus, I thought, this bright and shining genius may have a new idea and the burning out of the sawdust particles when the brick is subjected to heat may develop a desirable porosity.

We all know wood is inflammable but combustion cannot be created without the admission of air. Would these particles closely embedded in the fire brick burn out even when subjected to great heat? Common sense would answer in the affirmative. A test, however, would determine the question and so I asked to see the record of his test. It also would, show whether or not his brick resisted the great heat, as he claimed, and of the truth, as alleged, and of which I had grave doubts. He readily assented but said he would have to "go home and get it."

That was six months ago, the walking has been good but alas! he has not come back. Until he returns the user of fire brick may still obtain good service provided he exercises both his common and uncommon sense when he makes his purchase.

Molds Elbow with False Core

When Castings Are Required Which Do Not Warrant the Expense of Making Patterns for the Job, Foundrymen Often Use Short Cuts

By H. N. Tuttle

TO PROVIDE a short cut in the casting process, an interesting method was used in making a cast iron elbow about 10 inches in diameter and 2½ feet long with an absolute minimum of pattern work. That was the chief consideration, extreme accuracy not being required. The elbow is shown in Fig. 1. The octagonal opening *A* and the lugs *B* and *C*, like the rest of the elbow, did not require great accuracy.

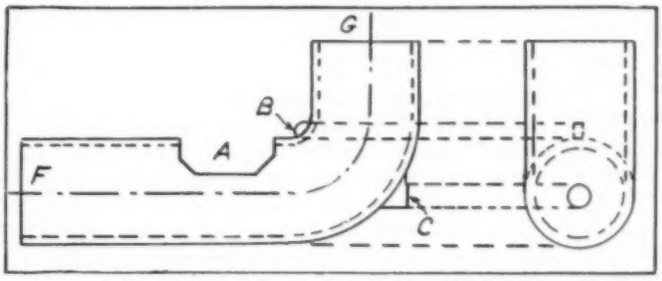


FIG. 1—THE ELBOW AS IT APPEARED WHEN COMPLETED

Outlines Molding Method

The first step was the making of a strickle board upon which to strike up the core sand pattern. The board, illustrated in Fig. 3, was an old layout board with the corner cut off on an arc whose radius was 1 inch larger than the corresponding radius of the elbow. That was used as a guide for running the strickle, which is shown in Fig. 2. The notch at *L* is a guide or stop for guiding the strickle around the rounded corner of the board.

The struck up pattern is shown in dot and dash line, Fig. 3. Half round heads *N* and *O* held square by the brackets *E* and *M* are used to support the ends of the struck sand work. Lines *F* and *G* represent the ends of the casting, corresponding to the same letters in Fig. 1. The remaining distance from *F* to *N* and from *G* to *O* is made for coreprints. *H* is the strickle.

The sand pattern was rodded well and two hooks placed in both the top

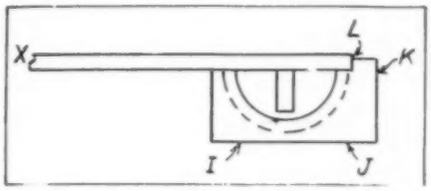


FIG. 2—STRICKLE USED FOR MAKING THE ELBOW CORE

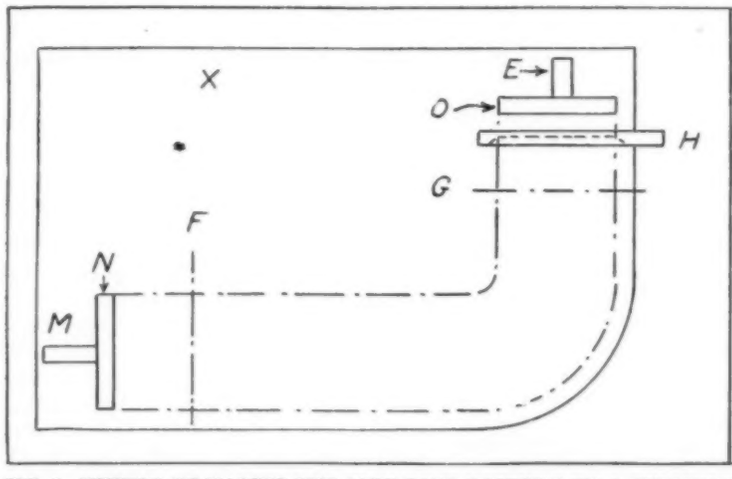
and bottom of the core. After one half the pattern was made, the board was placed carefully in the cold end of an oven and slowly dried until it was sufficiently stiff to be removed from the board. After that it was baked thoroughly. The heads *N* and *O* were removed and placed on the opposite side of the board, after which the other half pattern was made. After the sand patterns were baked, they were blacked, smoothed and given to the molder. The drag half pattern was laid on the bottom board and rammed. After the drag was rolled over the cope-half pattern was placed properly upon the drag half, with the edges flush. The two half patterns were nailed thoroughly along the edges to prevent a ramming shift.

The cope half was wired in the cope, so that in lifting the cope, the pattern came with it. The two half patterns then were drawn and sent to the patternmaker, who laid out the position of the desired casting, i.e., the lines *F* and *G*. The octagonal hole, *A*, Fig. 1, also was laid out. The metal thickness then was filed off the cores.

File off Metal Thickness

To assist in filing off the metal thickness with reasonable accuracy, a flat file was secured whose thickness was equal to the desired wall, 7/32-inch. Grooves, the width of the file, first were filed around the pattern, as shown at *S* at the left in Fig. 4. After the grooves were made, it was an easy matter to file off the spaces between them, without any appreciable variation.

The octagonal hole and the core-



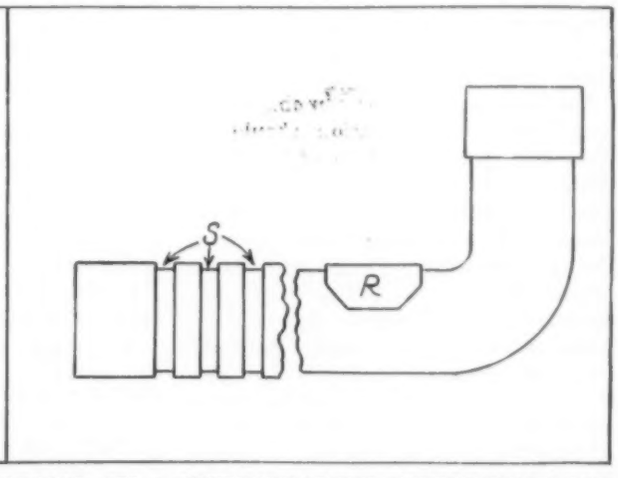


FIG. 3—METHOD OF MAKING THE CORE SAND PATTERN ON A STRICKLE BOARD. FIG. 4—LEFT HALF OF THE PATTERN SHOWS HOW THE METAL THICKNESS WAS FILED OFF. RIGHT HALF ILLUSTRATES THE APPEARANCE OF THE FINISHED CORE

prints, Fig. 4, were left without filing. The lugs *B* and *C*, Fig. 1, were laid out approximately by the patternmaker and cut in the green sand. The mold was brushed with plumbago, chaplets were set properly and the mold was poured two-up with good, hot iron. Resultant casting was smooth and true.

Higher Duty on Graphite Threatens

MANUFACTURERS and users of foundry facings and crucibles are faced with a serious situation due to changes which have been made in the tariff bill now before Congress. Since 1921 duties of 10 per cent on amorphous graphite, 20 per cent on crystalline and 1½ cents a pound on flake graphite have been imposed. Of course, a new rating was taken up in the tariff bill now in the making. The House changed the present rate to 5 per cent on amorphous, 25 per cent on crystalline and 1¼ cents per pound on flake graphite. The finance committee of the Senate again changed the tariff to read 5 per cent on amorphous, 20 per cent on crystalline and 1¼ cents per pound on flake graphite. On Nov. 1, Senator Black of Alabama offered an amendment to the bill already reported, bringing the rate on amorphous graphite back to 10 per cent and classifying all other types as crystalline graphite carrying a specific duty of 2 cents per pound. This amendment was adopted without debate.

Paragraph 213 of the tariff bill now reads as follows: Graphite or plumbago, crude or refined; amorphous 10 per centum ad valorem; crystalline graphite, 2 cents per pound. As used in this paragraph, the term "Crystalline graphite" means graphite or plumbago which occurs disseminated as a relatively thin flake throughout its containing rock, decomposed or not, and which may be or has been separated therefrom by ordinary crushing, pulverizing, screening or mechanical concentration process, such flake being made up of a number of parallel laminae, which may be separated by mechanical means.

Users of graphite or plumbago feel that further consideration should be given this item, as a duty of 2 cents a pound would handicap the industry seriously. Graphite used in the manufacture of crucibles and foundry facings comes from Ceylon and Madagascar and, it is pointed out, has qualities not obtainable in graphite found in the United States. Both the ways and means committee and also the Senate finance committee were shown that regardless of the amount of duty imposed on imported graphite, the industries mentioned still would be forced to use it. Manufacturers of crucibles would be faced with an additional burden and the cost of foundry plumbago would be increased approximately 1½ cents per pound if the bill is passed in its present form.

Several reports issued by the department of commerce, bureau of mines, and edited by Paul M. Tyler, show the unsuitability of domestic graphite for the manufacture of crucibles and foundry facings. The following is quoted from page 28 of circular 6118, issued April, 1929:

Some of the amorphous graphite mined in the United States has been nothing more than shale or slate containing only enough carbonaceous matter to make it black. Other qualities grade into anthracite. Usually it is the physical character of the product that is of utmost importance, and the value of crystalline graphite depends upon its structure and upon the size of the particle quite as much as upon the carbon content. Flake finer than 90 or 100 mesh, for example, is not acceptable to crucible makers, and much larger flake (up to about 12 mesh) is desired.

The following is taken from circular 6122 of May, 1929:

American graphite deposits, though numerous and often large, are characteristically low grade. They constitute an abundant source of potential supply, but in normal times they have proved relatively costly to work, and even at the same price, the various products (domestic) never have been able wholly to displace certain imported qualities, notably crucible grades from Ceylon and pencil graphite from Mexico.

That circular has the following to say regarding Alabama graphite:

The rock is largely quartz with some mica and apatite, and with rarely more than 3 or 4 per cent graphite. More efficient milling has made possible a 75 per cent recovery from rock containing only 2 per cent of graphite, the yield per ton being about 25 pounds of graphite.

California graphite is treated as follows in the circular:

The smallness of the flake makes it of little value for crucibles and refractories.

Further information is given in circular 6124 published May, 1929.

According to one authority fully 600 graphite mines have failed in the United States, and the records show that of all these properties, scarcely a score have succeeded in operating for as much as a year or two. Throughout the country, in fact, there are scarcely a dozen states in which efforts have not been made at some time to exploit graphite deposits. Failures inevitably occur in all kinds of mining, but the disheartening feature of the record of graphite mining in this country is that so few ventures have paid back the money put into them and none has been a conspicuous success.

The graphite industry, it should be remembered, is in many respects a complicated one. Attempts to state its problems as broad generalities tend to obscure the facts that there are three or four wholly different types of graphite with several grades of each type. Moreover, graphites of nominally the same grade may not be interchangeable because of differences in purity and physical condition.

Both Alabama and Pennsylvania graphite dust (and flake) were said to be of inferior refractory quality because of their large silica and mica content which fuses under heat.

American graphite is being offered now and has been for some period back, at a lower price than the foreign product. Even in the face of this condition, the output has decreased while the importation of graphite has increased.

All of the facts in the case should be taken into consideration before the tariff bill is passed. As it now stands, it will impose a great hardship on the industry. Graphite refiners and crucible manufacturers have done considerable research in the past to find a way to use American graphite satisfactorily, but without success. It is foolish to imagine that any industry would go half way around the world to Ceylon and Madagascar, carry large stocks of crude material which ties up capital for from 6 to 12 months, and pay higher prices, if it were possible to use the material found at home.

Taps First Heat

On Monday, Nov. 11, the first heat was tapped in the new foundry of the Cleveland Trade school. The school is one of the most completely equipped in the country for foundry instruction. Equipment in the institution was donated by Cleveland foundrymen, who have backed the project since its inception. The first class has 25 students under the supervision of J. G. Goldie, formerly of the Connecticut state board of education.

Builds

Rack and Pinion Patterns

Outlines Practice Pursued to Insure Necessary Accuracy and Strength in Construction of a Wood Pattern for a Small Spur Pinion, Also One for a Corresponding Rack

By J. G. Fitzpatrick

NOTHING but the best materials were used in the construction of the patterns shown in the accompanying illustration, a spur pinion 8.387-inch pitch diameter, 1¼-inch pitch, 2½-inch face with 21 teeth. The corresponding rack has 20 teeth. Body of the patterns were made of best seasoned dry pine. The teeth were made from straight grained mahogany.

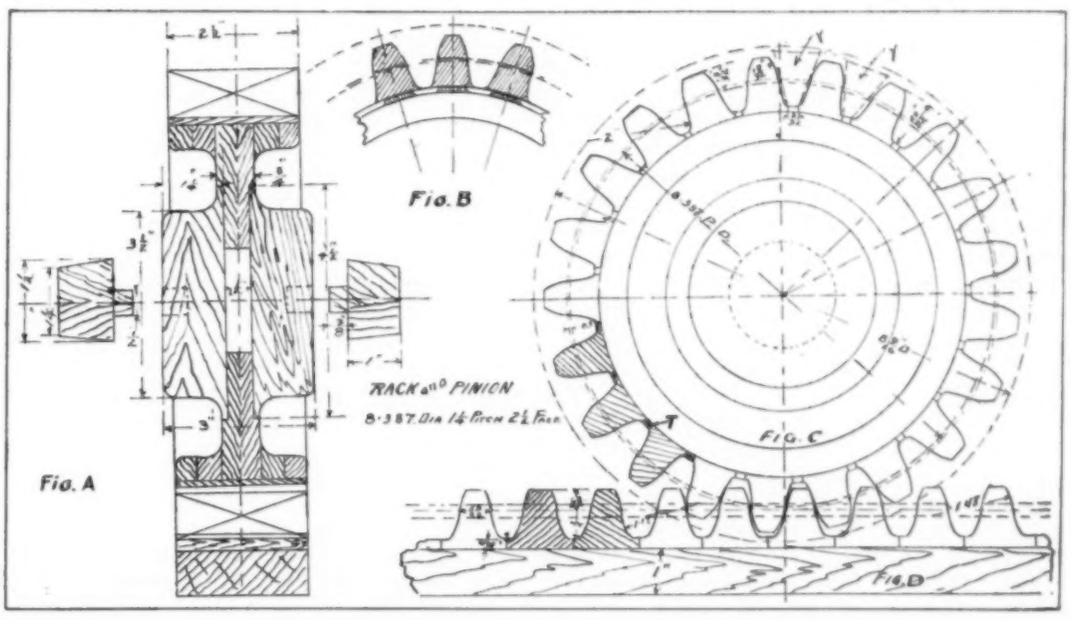
Two full size views were laid out on the board. One showing a section of the pinion and rack in mesh, *A;* the second *B* showing a plan view in the same position. The segmental method, admitted to be the most servicable, was employed in building the pinion body. The web or plate was made of two layers of segments, each ⅝-inch thick and each one a quarter of a circle. They were built up in the usual manner by gluing them to a wood chuck covered with a section of newspaper. The joints in the second row were staggered.

While the glue was drying the segments for the rim were prepared. Eight of these were required with an outside diameter of 7¼ inches and an inside diameter of 5 inches. This included the fillet shown at the joint of the junction with the web. Outside diameter of the next row was the same, but the inside diameter was increased to 5¾ inches. Eight of these, four for each side, cope and drag, were sawed out, each ½-inch thick. The two hubs then were sawed 5 inches diameter from 1¼-inch lumber. These blocks were turned to the shape of the finished hub, 3½ inches in diameter at the outer end and with a shoulder 4½ inches diameter at the inner end to fit in a recess in the web. This form of construction did away with a feather edge whether the hub was left loose or attached to the pattern permanently.

The body of the pattern then was built up by gluing the remaining segments in place on the web. The inside was turned to a diameter of 6 inches at the top and to 5⅞ inches at the bottom with a ½-inch fillet to blend with the web. A recess ⅛-inch deep and 4½ inches in diameter was turned in the center of the web face into which the hub was fitted. The pattern then was given a coat of yellow shellac. After this had dried the pattern was sanded smooth and removed from the face plate by inserting a chisel between the chuck and the pattern thus prying it loose.

The chuck was turned down until it was a tight fit for the inside of the pattern and the other side of the pattern was built up with segments and turned in the same manner. It was sanded smooth on the inside and shellacked. The outer face was divided into 21 spaces with radial lines drawn through the center. Sometime a hole is bored through the center of the web to accommodate projections on various hubs, but a solid web presents the advantage of preserving a center point.

Several methods are available for attaching the teeth blocks to the rim. They may be fastened by a dove tail as shown at *B*, or they may be cut to shape and just glued into place. The first method has merit, but it is impossible to form a proper fillet at the root of the tooth. The second method results in a weak pattern. In the method adopted as shown at C the rim on the body of the pattern was cut down to allow space of ⅛-inch thickness extra on the base of the tooth block. Space between each pair of teeth was filled with a narrow mahogany strip. This form of construction strengthens the pattern and



Sectional and Plan Layout for Wood Pattern of a Pinion and Rack

makes the molding operations easier.

The mahogany tooth blocks were planed to ⅞ x 1⅛ x 2⅝ inches. A center line was gaged on the ⅞-inch width and the blocks were then fitted against the rim on the 21 centers. A tooth block and a strip *T* as shown in the illustration *C* were applied alternately. Blocks were fastened with two No. 10 wood screws. Strips were glued and bradded. Wedge shaped pine blocks shown at *Y* in the upper part of the sketch *C* were glued between each pair of teeth to prevent any chattering while the outside face and ends of the teeth were being turned to the proper size. These blocks also provided a surface for the compass points while striking the radii for the faces and flanks of the teeth profiles.

Pitch lines and construction circles were struck from the center. The former was 8.387 and the two latter 8.562 and 8.125 inches respectively. Points for striking the faces and flanks of the teeth were marked on these circles and the width of the teeth was marked on the pitch circle. Faces were struck with a ⅞-inch radius and the flanks were struck with a radius of 2 inches. A ⅛-inch fillet was marked at each side of the root of each tooth.

Each tooth block in turn was removed from the pattern by sawing away the pine block and releasing the screws. It was cut to shape, sanded, glued in place and the screws were replaced. By treating the teeth in this manner each one was kept on its original center. The entire pattern then was given a coat of yellow shellac. When this had dried the surface was sanded and given two additional coats.

Core prints were turned to 1½-inch diameter, tapered as shown in the illustration *A* and with a ½-inch dowel left on to fit in a corresponding hole bored in the center of the hub. The prints might have been glued solidly in place, but in this instance they were left loose so that if necessary other prints and hubs might be used with the same pinion.

The rack pattern was planed to the required size, 1 x 2½ x 25 inches and the upper surface was stepped off into 20 spaces each 1¼ inches apart and representing the pitch centers. The lines were projected across the face with the square and the teeth blocks were prepared from straight grained mahogany. They were cut from sticks about 15 inches in length and planed to a size of 1¼ x 1$\frac{3}{32}$ x 2⅝ inches. A center line was gaged across each 1¼-inch face and from this center the blocks were set and glued to conform to the centers marked on the backing or base strip. These blocks were glued permanently and faced to 2½ inches. The pitch line and construction lines were gaged thereon. The center of one tooth then was squared through and from this center the remaining pitch centers were stepped off. The face of each tooth was struck from a point on the construction line as shown in *D*.

The flanks were struck in the same manner with 1.17 radius, but from different centers. The surface was finished and sanded. The blocks were secured by two 1½-inch wood screws and the entire pattern was given a coat of yellow shellac. After this had dried the surface was sanded smooth and covered with two additional coats.

Wire Rope Needs Good Lubricants

By C. D. Meals

MOST users of wire rope know that at the time the rope is made, its core is impregnated with a chemically neutral lubricant. However, that initial lubrication of the core is not permanent and if maximum life is to be obtained from a wire rope, a lubricant of proper grade must be applied properly at frequent intervals. Life of a rope is influenced by method and materials of construction, manner of winding, intensity of service, high temperatures, presence of water, acids or alkalies and lubrication. The latter factor is one of the most important in determining how long a wire rope will last.

Wire rope cores are of two main types, those with hemp and those with wire rope centers. However, a core of hempen fiber is employed in the majority of cases because it protects the wire against corrosion and rusting of the inner strands, insures the maintenance of adequate flexibility with a minimum of friction when the rope first is put into service, and preserves the fibers of the core. That type core also serves as an absorption medium for the lubricant and as a cushion for the strand's interior faces.

It is necessary to lubricate wire rope to retard rusting and corrosion, to reduce the internal friction between the inner strands, to reduce the external wear by minimizing the friction between the outer surfaces of the rope and drums or sheaves and to decrease the deterioration of the core by maintaining it in the proper state of softness and pliability.

Wire ropes generally are divided into five classes. Those operated at slow speeds and under heavy load; high speed hoisting ropes; haulage and slope ropes run at high speeds under heavy loads; general haulage ropes and ropes of lighter duty than those previously mentioned and stationary ropes exposed to moisture, corrosive fumes, etc.

Each of these classes of rope demand a different lubricant. The specifications for them range from a straight petroleum product with a viscosity of 900 to 1100 seconds, at 210 degrees Fahr. for the first mentioned class to a mineral oil lubricant with a viscosity of 200 to 300 seconds at 210 degrees Fahr. for general haulage ropes.

In selecting a lubricant for a wire rope care must be taken that it is fluid enough to penetrate the strands and the core but not so fluid that it will run off the rope or so viscous that it merely covers the rope. Tar products do not make good lubricants since they often contain tarry acids, corrode the rope and eventually harden, crack and peel off the wire strands. Greases usually are deficient in adhering and penetrating qualities.

It is better to use a thicker semi-plastic lubricant and thin it by heating and apply it hot than to put on a more fluid lubricant cold. The greater the speed of a rope in service the lower should be the viscosity. Crude oil usually is injurious to the core and the steel in the rope when used as a lubricant.

As has been previously mentioned, it is better to apply the lubricant hot than cold. This may be done by passing the rope through a heated bath of oil. An apparatus for this may be constructed easily. The alternative method is to apply the lubricant by hand but this is a wasteful and messy process, and results generally are not good. Another method is to place a drum of the lubricant warmed by a steam-heated coil and allow the lubricant to run on the rope through a suitable outlet valve. A brush for spreading the lubricant should be placed with its bristles up, below the point from which the lubricant flows.

Oxygen Causes Hard Iron

Many Years of Observation Show That Variation in Blast Furnace Practice Will Produce Iron of Same Analysis but Different Physical Character

By James A. Lanigan

RECENT discussion on quality pig iron has prompted the following presentation, result of over 20 years observation and investigation on why two pig irons of the same analysis should produce castings differing widely in physical properties. By the same analysis, of course, is meant the elements commonly taken into consideration in figuring any mixture for an anticipated result, silicon, sulphur, phosphorous, manganese and carbon.

Opinions differ as to whether the furnaces at present are producing pig iron inferior to that produced 15 or 20 years ago. To the writer's knowledge there is no record of such being the case and this also is claimed by the furnace operators.

Should Be Better

In fact and on the whole, pig iron produced today should be superior to that produced 20 years ago, due principally to improved working conditions on the furnaces and the elimination of objectionable materials from the furnace burden, mill cinder, old annealing pots and material of a like character.

Therefore the question is, or should be, what element in pig iron sometimes is present in such quantity as to render the iron unfit for foundry use. If this dangerous element could be eliminated, the process would take care of the subject matter in Dr. Moldenke's paper "Evaluation of Foundry Pig Iron" presented before the 1927 convention of the American Foundrymen's association in Chicago.

What are the predominant characteristics in the questionable pig iron? In the writer's experience with this iron, also in similar experiences of others the main characteristic has been the power to exert a hardening influence on any mixture in which it was used, an influence out of all proportion to what should have been expected from the analysis. A recent experience in the Chicago district, one of many of a similar nature met in widely separated parts of the country, will serve as an illustration.

A certain mixture was used insuring uniform iron, soft enough to allow the use of high speed reamers on light castings. Suddenly the castings came so hard that trouble of a serious nature was encountered with the cutters. Analysis of the iron was identical with that of the iron which had been running satisfactorily on the same class of castings for some time previously.

In the following heats I had chill tests cast, 1¼ x 5 x 6 inches. These chill pieces when broken showed exactly what I had encountered in all previous cases of the kind. Taking one half of the chill test piece to the stock yard and having pigs from each car contributing to the mixture broken, I determined from a comparison of the fractured surface of the test piece with the fracture of the pigs which was the offending car. Fracture and color test piece and pig iron were identical.

Pig iron from the marked lot was omitted from the heat on the following day. The castings were satisfactory without any change in the analysis showing silicon, sulphur, phosphorus and manganese. No foreign scrap was used in the mixture and the cupola operations conformed to the best accepted practice.

Describes Metal Fracture

Now, what was the peculiar characteristic noted in the fracture of the chill block? This fracture in the test block and in the pig iron resembled the fracture of a burned locomotive grate bar. The color was dull black, with a decidedly dead appearance and fine grained.

A test block of the dimensions described with the following approximate analysis: Silicon 1.90 per cent, sulphur 0.08 per cent, phosphorus 0.35 per cent and manganese 0.55 per cent and cast on edge on a chill surface will show a chill of about ⅛-inch with a distinct, clear, sharp line separating the white or chilled section from the black or dark gray section without any blending or graduating whatever. This characteristic never has varied in any of the cases of like character coming under my notice in a period of over 20 years of observation and thought given to the subject.

Conclusion of the writer reached long ago is that oxygen in solution as an oxide is the cause of the trouble, but in what percentage I have not been able to determine. If, as Dr. Moldenke said over 20 years ago, that 0.03 per cent of occluded oxides contained in white iron was sufficient to completely ruin that iron, it is quite probable that the same percentage or even considerably less in gray iron would ruin it altogether for casting purposes. These occluded oxides are more powerful than sulphur in their hardening influence. Also they reduce the transverse strength, tensile strength and amount of deflection.

Look for Light

Oxygen is present in cast iron as iron oxide in varying percentages. Its harmful influence is known. The fact that the amount of the element is difficult to determine chemically, added to the high cost of such determination, should not hold back the lime light from playing full force on the whole question. Foundrymen should be as familiar with the effects of occluded oxides as they are with the functions and effects of the other elements in cast iron.

In his paper on the evaluation of foundry pig iron, Dr. Moldenke claims the blast furnaces have become huge cupolas and have ceased to exercise the primary functions of a blast furnace, a deoxidizing operation entirely or in part. Under present conditions of operation, oxidizing influences predominate. "Furnaces are loaded with borings, tin scraps, burnt scrap of all description, regular grave yards for old flivvers," to quote from James A. Murphy's contribution to the Chicago discussion.

Operating with such a burden and with the added causes of trouble, control of temperature, hanging stock, scaffolding, wedging, slipping, pillaring and many others which do their part toward throwing the furnace out of control, it should cause little wonder that occasionally the foundryman will receive lots of worthless iron highly contaminated with occluded oxides.

David McLain contributing to the same discussion stated that a further analysis should give data on many metalloids other than carbon, silicon, sulphur, phosphorus and manganese. The writer believes that what really is wanted is a thorough knowledge of the effects of various non-metallic elements, particularly oxygen, on cast iron.

Without doubt a larger tonnage of better pig iron is produced today than heretofore, but also without doubt a much larger tonnage of bad pig iron also is in the market. The reason the foundry industry is not much worse than it is today is that the great majority of present day foundrymen are familiar with the metallurgy of iron. They can say definitely what constitutes good iron.

If they were given a pig iron of 20 years ago, or that of any other period, they could produce castings equally as serviceable as any castings of any description produced any place today.

Nonferrous Group Plans Shop Course

A nonferrous shop operation course for brass foundrymen will be held during the Cleveland convention of the American Foundrymen's association, May 12-16, 1930. The course will be similar to those held at several recent conventions for gray iron and steel foundrymen. The subjects which will be discussed during the course include crucible, open fire and electric furnace melting practice, gating and the effect of pouring temperatures in pouring practice. The course will be held at 4.00 p.m. during the days in which the convention is in session and each subject will be in the hands of a leader who is an authority on the particular phase of brass foundry practice under discussion.

Foundrymen See Movie

G. R. Fritterer, assistant metallurgist, United States bureau of mines experiment station, Pittsburgh, spoke before the Philadelphia Foundrymen's association at its regular November meeting held Nov. 13, at the Manufacturers' club, Philadelphia. A 5-reel motion picture entitled "The Story of Iron," prepared by the United States department of commerce, was shown accompanying the talk by Mr. Fitterer.

George W. Elliott, general secretary, Philadelphia chamber of commerce, also spoke on the chamber's program of co-ordination and co-operation in industrial circles in Philadelphia.

Study Liquid Shrinkage

Progress in the investigation of the problem of liquid shrinkage, being carried on through the co-operation of the American Foundrymen's association and the bureau of standards, is indicated in a report submitted by E. J. Ash, research associate for both organizations, to the committee on cast iron of the American Foundrymen's association.

The first investigations were carried out on cone-shape specimens cast in dry-sand molds. The external pipe and internal voids were determined by weighing, filling the pipes with wax, and calculating the volumes. However, true shrinkage values could not be obtained due to inability to obtain the exact temperature of the metal when the mold just is filled due to nonuniformity of metal temperature, and because a volume change takes place in some of the metal during the casting period.

Consequently, a new procedure was developed which is termed the crucible immersion method. This consists in immersing a crucible of known volume into a ladle of molten metal and filling the cavity of the crucible, allowing sufficient time for the crucible and the metal to reach a temperature equilibrium. When this state is attained a lid is pressed down firmly on the crucible and the whole removed from the melt. After cooling, the resultant ingot is weighed, and through the known volume of the crucible, the specific volume value of the metal at the temperature of sampling may be determined. Results obtained with 98.5 per cent aluminum show a solidification shrinkage, based on liquid volume at 656 degrees Cent., of 6.4 per cent. This method only can be used to collect data for constructing the specific volume curve of the liquid metal. Also it will be possibe to express the relative tendency of metals to distribute their solidification shrinkage between external pipe and internal voids. This distribution may be largely a function of the quantity of heat contained in the lid which acts as a hot top. Similar data will be obtained for zinc, No. 12 aluminum alloy, lead and probably the 85-5-5-5 brass. Following these the work will continue in collecting data on cast iron.

Ingot Mold Casting Weighs 105 Tons

THE large tapered ingot mold casting shown in the illustration above, weighs approximately 105 *tons and was supplied recently by the Brightside Foundry & Engineering Co. Ltd., Sheffield, England, to the River Don works of the English Steel Corp. Ltd., Sheffield. It was cast by means of a series of stand and tilting ladles, and cooled in the sand mold for four weeks. This ingot mold is the largest of its kind which the English Steel corporation has employed and is to be used in casting ingots weighing up to* 160 *tons for boiler drums. Transportation of the casting was difficult because of its great weight and bulk, but with the aid of five tractors it was transferred from the foundry to the works of the English Steel corporation in a comparatively short time.*

Buffalo Founders Meet

At the regular monthly meeting of the Buffalo Foundrymen's association, held at 140 Chandler street, Buffalo, Thursday evening, Nov. 21, James W. Gibney presented an interesting resume of his experiences as a member of the American foundrymen's party which attended the third international foundry congress in London, England a few months ago and which toured several of the continental European countries afterward. Pat Dwyer, engineering editor, THE FOUNDRY, delivered an address on American foundry practice in which he took occasion to comment on some of the points of difference which distinguish the industry on both sides of the Atlantic. W. Wark, manager of the Buffalo division, E. Woodison & Co., Detroit, is secretary of the association.

Bernard Nagelvoort, formerly plant manager of the Murray Corp., Detroit, has been appointed sales engineer of the Rotor Air Tool Co., Cleveland, with headquarters in Detroit.

The FOUNDRY Family Photograph Album

Upper Left

E. V. PANNELL

London Aluminum Co. Ltd., Birmingham, England

Lower Left

M. J. EVANS

Whiting Corp., Harvey, Ill.

Upper Right

J. M. TRANTIN JR.

Minneapolis Electric Steel Castings Co., Minneapolis

Lower Right

H. O. LANGE

Ferguson & Lange Foundry Co., Chicago

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

HINTS FOR THE CORE ROOM

(*Continued from Data Sheet No.* 790)

Composition: Wheat flour is composed of varying proportions of gluten, starch, fat, water and ash depending on the grade; the higher the gluten and starch content the more effective it is as a binder. The high ash content of the shorts, offals, and sweepings exclude them as effective binders.

Mixing instructions: Add binder to sand and mix thoroughly for 2 to 3 minutes. Then add about 10 per cent tempering water by volume and continue mixing 5 to 7 minutes longer. Paste binders require longer mixing than oil binders to give the water and flour time to form a paste and be distributed properly. Sand, binder, and water should be measured accurately and mixing done in a mechanical mixer.

Baking conditions: The recommended baking temperature is 325 degrees Fahr. The bond breaks down rapidly at higher temperatures and decomposes at about 500 degrees Fahr. Cores skin dry in the air and bake quite rapidly. Strong bond and excessive moisture have a tendency to cause the cores to swell out of shape. During baking large volumes of gases are generated because of the great amount of binder and moisture necessary, and therefore good draft and air circulation is necessary.

Use: Wheat flour as a binder is disappearing and is not used as extensively as in the past. The disadvantages of wheat flour as a binder are:

1. The binder itself molds, and deteriorates in storage quite readily.
2. Cores draw moisture readily and lose their strength.
3. Cores have a tendency to swell giving inaccurate cores.
4. During baking and pouring wheat flour gives off objectionable noxious gases.

Wheat flour binder still is used quite extensively for stock cores, wheel center cores, and to some extent on other cores where a green bond is desirable. However, corn flour is replacing it as a green bond and pitch and oil are replacing it in large cores because of their resistance to the absorption of moisture.

Core mixtures: A bond ratio is obtained with a clean silica sand of from 1 to 12 to 1 to 20.

Stock core mixture:

50 parts clean silica sand.
1 part good grade core oil.
4 parts wheat flour.

Center cores for bronze bushings:

14 parts sharp sand.
4 parts molding sand.
1 part wheat flour.

(*Continued on Data Sheet No.* 792)

HINTS FOR THE CORE ROOM

(*Continued from Data Sheet No.* 791)

Corn Flour

Specific gravity: Approximately 0.45; Average weight per gallon 2.5 to 4.5 pounds.

Composition: This flour is made from corn and it contains high content of starch, dextrine, and water soluble extract.

Mixing instructions: Add binder to sand and mix thoroughly 3 to 5 minutes. Add about 10 per cent water by volume for tempering and continue mixing for from 3 to 5 minutes. Sand, binder, and water should be measured accurately and mixing done in a mechanical mixer. When used with oil *do not add oil* till after sand, flour, and tempering water have been thoroughly mixed first. It also must be remembered that it requires longer mixing and more tempering water for the paste binders.

Baking conditions: The recommended baking temperature is 325 degrees Fahr. The bonding constituents are destroyed at about 500 degrees Fahr. and at temperatures above 325 degrees Fahr. the bond breaks down quite rapidly giving a weak core. When used with oil a relatively long bake at 325 degrees Fahr. will give the combined baking strength of both the binders but if the temperature is carried higher, the bond due to the corn flour will be lost. Considerable amount of gases is generated during baking and oven must have good draft so as to carry away these gases.

Use: Corn flour is used alone as a binder, but it is used more frequently along with other binders to give a green bond to the mix. It has considerable dry bond strength too and when used in multiple with other binders the amount of the other binders can be reduced materially providing they are mixed and baked properly. Corn flour develops green bond much better than wheat flour and the cores are not so apt to swell. It is also a much more stable binder and more resistant to moisture absorption than other flours. Also it is a stronger binder and gives a mix which draws from the boxes with the minimum of sticking. Cores do not sag or swell and less noxious gases are produced during pouring.

Core mixtures: Corn flour bond can be used effectively with clean open silica sand, molding sand, or combinations of both. It is more effective on clean open sands. Bond ratios of from 1 to 25 to 1 to 50 by volume are being employed when corn flour is used alone. The heavier flours give more dry bond while the lighter ones exhibit more green bond. Corn flour binders are used more commonly with other binders than alone.

Small cores for gray iron castings.

90 parts clean open silica sand.
1 part good grade core oil.
4 parts corn flour.

(*Continued on Data Sheet No.* 796)

Bill Favors One-Part Pipe Cores

By Pat Dwyer

MANY times I have heard or read the statement that all things come to him who waits. Sometimes the statement is varied to: Him who knows how to wait, but in its essence the meaning is the same. If one waits long enough everything will come to him. 'Tis a comforting reflection if one has the necessary faith, but after waiting over a long period of time for a certain event to come to pass, one's faith gradually seems to evaporate.

At one time or another while the old mental engine has been idling, I have wondered if there was not some fundamental reason why some men remain at the foot of life's ladder, others climb up part of the way and others never stop until they reach the top.

If I had the time, the inclination and sufficient means to maintain me in comfort while pursuing a deep and searching investigation of the subject, I finally might hit on the secret, but —as you probably will remark—If I was endowed with all these blessings, why should I take the trouble to pursue anything? Possibly I might have found the time. The lagging inclination might have been whipped up a little, but up to the present, the third factor in the equation has seemed to elude me and as a result I have made no progress in solving the problem. To be perfectly frank I have lost no sleep and the appetite remains normal, but, as I say the point pops up now and again like a hair in the soup. Nothing to call out the reserves over, but mildly irritating. Today, without any effort on my part the mystery was solved and another ardent adherent has been added to the army of true believers who quote the stanch old proverb: Everything comes to him who waits, or as hereinbefore stated in the revised version, him who knows how to wait. The wait has been long and, at times, discouraging, but now that I have been privileged to peep inside the temple of knowledge, all that is forgotten.

All a man has to do is to pick a certain month in which to make his debut in this well known vale of tears and his future is assured. The stars decide his destiny. You have heard that many times. So have I. You did not believe it. Neither did I—until today. Of course now it is too late to do anything about it, but at least the mystery is cleared up and I no longer need to worry because I am not seated near the head of the table.

Personally, I never have gnawed my nails and wept bitter tears when I have been seated near the foot of the table, instead of being seated at the right or left hand of a man temporarily in the limelight. Provided the supply of food was fairly plentiful in my immediate vicinity, or within easy asking distance, I have been content.

To my deep chagrin I now learn that attitude is part of my inheritance, the fate to which I am doomed as a result of being born in a certain month. Had I been forehanded enough to insist on another birthday, the principal chair always would have been reserved for me without any effort on my part. I would not need to sulk or pout or have recourse either to force of arms, tears, or threats to retire to my villa in the country. Presuming upstarts seeing me coming, would slink down along the side lines and efface themselves behind one of the baskets of flowers. Not a peep out of 'em.

All this and much more—Oh! much more—was disclosed to me by an extremely voluble citizen who drifted into my den today.

A chance remark on my part, touching on the measure of success achieved by Henry Ford, was met by a deprecatory wave of the hand and the reply that the success was inevitable. Henry was born in April—or was it May?—Oh, well, never mind—you can't cash in on the information now—and every man born in April is a natural born organizer on a big scale and a natural winner. The speaker modestly admitted that he himself, had been fortunate enough to arrive in the old home town during that fortuitous month. Look me over kid, he intimated, or words to that general effect, and see for yourself.

As I said before, I have speculated idly at one time or another on the manner in which men progress or fail to progress, and here apparently was the opportunity for settling the question definitely. Strike while the iron is hot and all that kind of thing. I struck. "Tell me" I implored this honest citizen "Do you real-

THE SMITH AND HIS HELPER GO INTO CONFERENCE

ly believe that the date of a man's birth actually exerts an influence on his life work?"

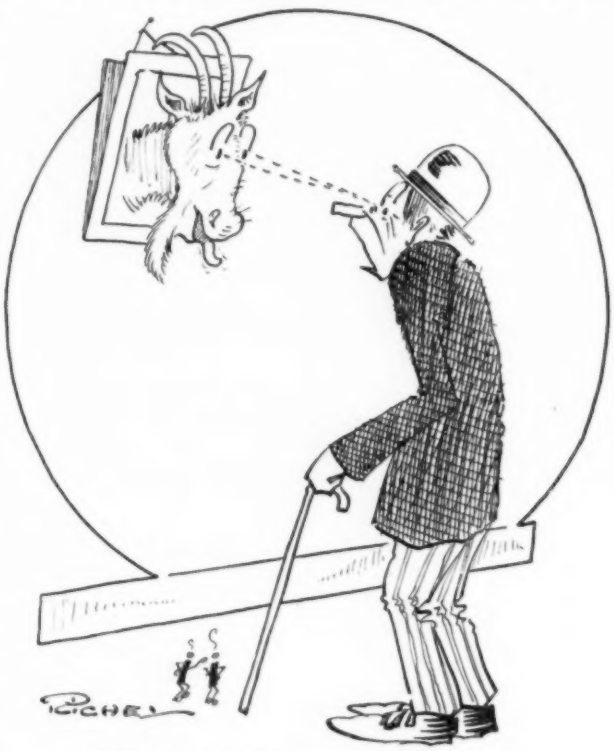
"Do I?" quoth he "Do I believe that night follows day, do I believe that sunshine follows rain? Do I believe that death follows life, that the changing seasons follow each other with unfailing regularity, that the trees of the forest die in the fall and burst into bloom again in the spring and that the birds that flew south in the fall wing their way again to the north when the first balmy zephyrs blow? Do I believe that the sun which disappears each night in the west will rise again the following day in the east? Do I believe—say—kindly correct me if I have the quotation wrong—there are more and stranger things in the heavens and earth, than ever were dreamed of in your philosophy, Horatio! And I don't mean Horatio Alger! Listen! If the stars were not intended to influence men's lives, why do you suppose they were sprinkled throughout the firmament?" Here he tapped me confidentially on the knee as much as to say "Come on now young fellow, show me whether you are an intelligent human being or a worm that just has crawled out of its hole to take the air." I had some confused idea of asking him if he attached any importance to Hollywood stars or to the hard iron stars employed in tumbling barrels, but before I could formulate the thought into words, he swept along. I think he knew he had me hanging on the end of the limb. The question and the pause which followed, merely were staged for rhetorical effect. He did not expect any answer.

Looking back now I can think of several shrewd sprags I might have poked in his wheel to either wreck or derail his train of though, but you know how it is. None of these brilliant inspirations arrive until it is too late to use them.

"For thousands, perhaps millions of years" he continued, "the wheeling constellations have held their appointed places and gone through their appointed evolutions in space. Wise men of the past and present have charted their courses and in the past and present have noted their effects on the lives and fortunes of the teeming millions of men who have inhabited the earth for the comparatively brief span of life.

"Hannibal knew 'em. Julius Caesar knew 'em. Napoleon knew 'em. I'll tell the world he knew 'em. Before he left the island of Corsica to learn how to become a soldier he knew that his star of destiny would carry him far and high. Did the stars do the trick? Why should I ask! You are an intelligent man. You have read history. You know as well as I, that he started as a second lieutenant, a two-spot down at the bottom of the deck. In a few years he was a royal flush, right and left bower, big and little casino, hi-low Jack and the game."

"How about the other months" I asked "What fate awaits those who are born in January, February and the remainder of the twelve months?"



THE FACE OUTSIDE THE BAR ROOM DOOR

By this crafty question I sought to check up on my own career. If I were to tell him the date of my birth I felt he might be biased one way or the other in giving me a true horoscope. In giving him a free hand I could dismiss all the others and note how close he came to the mark on my own particular month.

He knew them all. I was deeply pained to find that in selecting my natal month I had passed up practically all the good ones. On the other hand I was pleased to discover that inadvertently I had not made my initial appearance during a month that you might describe as a complete washout.

According to the dope, if one may be pardoned for employing such a plebian term in this connection, men born under the stellar combination which reigns during my pet month, are strong and husky in body, but rather weak in the upper story. They make excellent workmen in any occupation that demands endurance and great muscular development. They are docile, obedient, painstaking and take a naive delight in working long hours at the most laborious forms of occupation.

After the regular day's work is over they love to work around the home. They dig cellars, put down concrete walks, chop wood and clean the chimney. Between times they beat carpets, clean the windows, take the old flivver apart and put it together again. They regard books and papers as inventions of the evil one for the encouragement of idleness. They pick up pins, collect string and save all the rusty nails. They wear a suit of clothes until it falls apart. Never chew, smoke or drink and invariably live until they are 100 years old. In a word, they are the hewers of wood and the drawers of water. This is their destiny. The stars foreordain it for them and they cannot escape it. Tonight when Bill dropped in for a quiet draft of the weed I retailed some of this interesting material for his benefit and asked him if he placed any credence in this theory of p l a n e t a r y influence. He laughed. "Stars me eye" he remarked flippantly "Look at your own case. I won't say but what the lad hit it off rather neatly on the weak head item, but the stars had as much to do with that as they had in giving you flat feet and a gullible disposition. If you were born under any star it must have been Gemini the twins. You are as lazy as any two ordinary men.

"You waste more time than the stuttering blacksmith and his stuttering helper.

"The smith pulled a piece of iron out of the fire, laid it on the anvil and said to his helper: 'Huh-hu-hu-h-h-hit it!'

"The trusty helper poised his hammer and said: 'Whu-whu-whu-where, sh-sh-sh-shall I hu-hu-hu Hit it?'

"'Oh! heh-heh-hell' the smith exploded 'ya-ya-ya stut-tut-tut-tut-erin' dummy, the iron is co-co-cold now an' I have to st-st-st-stick it back in the fi-fi-fi-fire again!'"

"When I was a kid" Bill resumed "books were scarce in our modest little cot and as a result I pored diligently over the patent medicine almanacks that were distributed freely

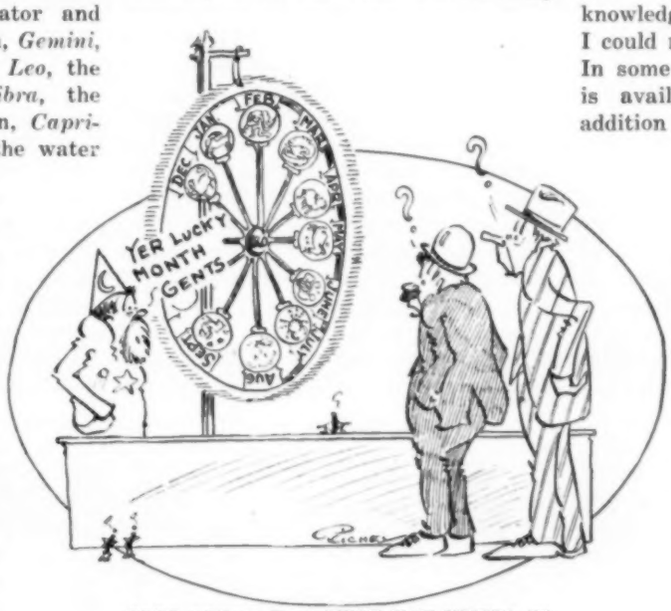
in the fall. Every one of 'em had a picture of a man shown partly in section with guide lines from the several parts of his anatomy leading to the several signs of the zodiac arranged in a grand circle.

"The accompanying text explained how the various parts of the body were influenced in sickness and health by the relative position held by the zodiacal signs at the time of birth. Also in a general way how a man's disposition corresponded to the characteristics of the zodiacal symbols.

"Thus a man born under the sign of *Aries*, the ram, would be pugnacious, under the sign of *Sagittarius*, the archer, he would be a hunter, under that of *Taurus*, the bull, he would be brave and strong. So on, as the sun swung north from the equator and entered them all in succession, *Gemini*, the twins, *Cancer*, the crab, *Leo*, the lion, *Virgo*, the virgin, *Libra*, the balance, *Scorpio*, the scorpion, *Capricornus*, the goat, *Aquarius*, the water bearer and *Pisces*, the fishes. I kinda lost faith in the thing when I discovered that I had been born under the sign of Capricornus, the goat. Any lingering doubts I may have had were dissipated several years later when I learned what happened to an old boyhood chum. He was born under the sign of *Virgo*, the virgin and his parents had great hopes of making a cleryman out of him. He was a model youth up to the year he was to enter the seminary. Then he got mixed up in a drunken row and ran away. He shipped on a barkentine out of Baltimore and when last I heard of him he had been all over the world and had married a wife in every port he visited.

"Some men believe in signs and others prefer to use their own common sense. I had a letter the other day from a foundryman who had a hunch that a certain method for making cores was better than the one in vogue in his foundry and he wanted my opinion.

"He wrote that he was making some special pipe fittings, bends, elbows, tees, etc., ranging in size from 18 to 36 inches. A difference of opinion had arisen over the best way to make the cores. On similar jobs in the past, the cores had been made from a regular core sand mixture, dried in the oven in halves and afterward pasted. Due to crooked plates, sagging and difficulty in assembling the halves, the cores never fitted properly. In the present instance he proposed to make a half corebox for each pattern, place a good, stiff arbor in each core, the arbor to be made of a strong central member with a number of wings wedged in place, corresponding to the diameter of the core, after the manner of bars in a cope. The first or bottom half of the core to be made in the usual manner by adjusting the arbor in place in the corebox and ramming it full of sand. The upper part of the core to be made by building a mound of sand on the lower half and forming it to the correct shape by a suitable strike traveling on guides on the joint of the corebox. He intended to make the core from an ordinary dry sand mixture, lift it out of the box complete and dry it in the oven. The foundry



ODDS ARE 12 TO 1 THAT YOU MISSED IT

foreman claimed this style of core is not practical. He said the water in the core will be driven to the bottom of the core where it will cause the sand to fall off.

"Of course that is all piffle. I assured him that the plan he proposed for making the cores is the best under the circumstances, where only one, or, at best, a limited number of castings is required. He might go a step farther and make the cores in green sand instead of going to the bother and expense of drying them. On the larger sizes he might observe the precaution of skin drying the under side of the core, but the remainder of the core surface only requires a light coating of plumbago applied with the hand or with a brush. If a little coal dust is mixed with the facing sand, the core will leave a perfectly clean surface on the interior of the casting. The bottom of the core between the arbor wings is gaggered after the fashion of a cope surface. A green sand core will fit the prints more snugly than one made in dry sand and thus eliminate the necessity of first shaving the prints in the mold and afterward chipping unsightly fins on the casting. The projecting ends of the arbor furnish a ready means of anchoring the core in place. Complete circular wings take the place of the half circles at points on the arbor corresponding to the ends of the core prints on the pattern. These circular plates are designed to rest on suitable iron bearings in the mold and thus support the weight of the core.

"However, if a desire for extra safety prompts the foundryman to dry these cores, he may proceed without any qualms, if he uses any ordinary dry sand mixture and does not work the mixture too wet. Without a knowledge of the sand he is using, I could not suggest a definite mixture. In some places a natural coarse sand is available, which only needs the addition of a small amount of binder. In other places a considerable amount of sharp sand must be mixed with the molding sand to open it up and then sufficient artificial binder must be added to bind the sand in a solid body when it is baked. In all probability he has a standard mixture in the shop for making dry sand molds. The same mixture will serve for the cores. If the first core shows any tendency to scab, the sand for the succeeding cores may be opened with a little sharp sand. It is not necessary to make the entire core from the special mixture. A thickness of 1 or 2 inches is all that is required. The remainder of the core is filled with old heap sand, with a generous allowance of coke in the center to insure a clear vent.

I advised him to leave at least 1 inch clearance between the edges of the wings and the face of the core. Where the wings fit too closely, the casting will not contract uniformly. The horizontal diameter will be greater than the vertical diameter on account of the resistance offered by the wings of the arbor.

Appoints Office Managers

Joseph P. Fletcher, manager of the Buffalo office of the Independent Pneumatic Tool Co., Chicago, has been appointed manager of the Philadelphia office to succeed the late A. L. Schuhl. W. O. Becker of the Toronto, Can., office, has been appointed manager of the Buffalo office.

Die Castings

Are Produced from Various Nonferrous Alloys

By J. B. Nealey

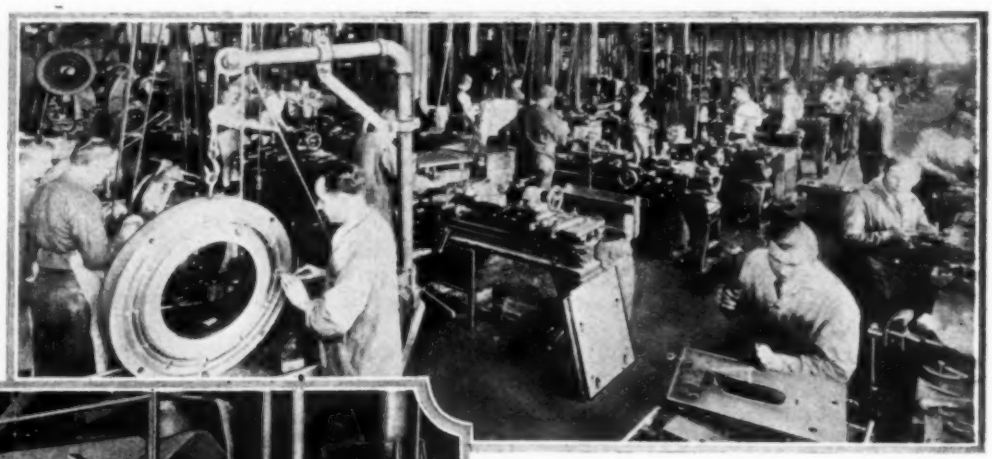
CASTING of metals, especially low-temperature alloys, in permanent metal molds is a rapidly expanding industry and one that will continue to gain in volume as improvements in the die metals are made so that the dies will stand up under higher temperature alloys. At the present time 1400 degrees Fahr. is about the limit of die casting alloys under pressure, for the dies will deteriorate rapidly, if used with anything running at higher temperatures.

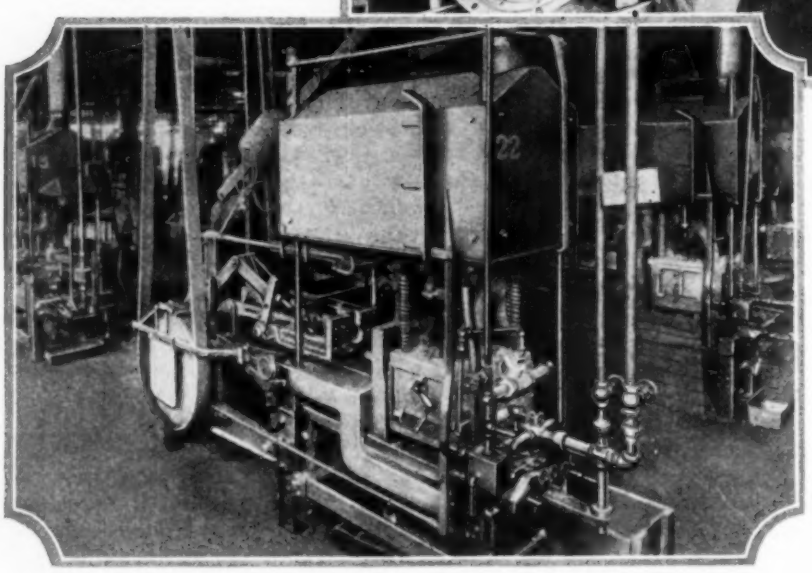
For instance, the melting point of copper, brass, etc., runs about 2100 degrees Fahr., and it would not be practical to confine these metals at this temperature under pressure in present day dies as the dies would go to pieces. Pressure is a big factor here for the hot metal is forced into the dies at pressures ranging as high as 600 pounds per square inch.

One of the largest die casters in the country is the Alemite Die Casting & Mfg. Co. with plants in Chicago and Woodstock, Ill. This company uses alloys of four different metal bases as follows: Aluminum-base, zinc-base, tin-base, and lead-base. The brass and bronze alloys have not as yet been commercially cast under pressure although they are cast in permanent holds at atmospheric pressure. However, for economy, volume production, minimization of machining, sharp definition of outlines, close grain structure, and the making of intricate shapes, casting under pressure is necessary.

Among the best known aluminum-base alloys is that containing 92 per cent aluminum and 8 per cent copper, which also is used extensively for most aluminum sand castings. An aluminum-base alloy containing a small quantity of silicon, with a melting point of 1150 degrees Fahr. has a tensile strength of 20,000 pounds per square inch.

A die casting alloy that compares favorably with cast iron in physical qualities is a zinc-base alloy containing zinc, tin and copper. This alloy has a tensile strength of 18,000 pounds per square inch, an elongation of 1 per cent in 2 inches, a brinell hardness of 52 and melts at 825 degrees Fahr. It also can be plated and weighs only about a quarter of a pound per cubic inch. Another alloy of the same base with aluminum instead of tin has a tensile strength of 40,000 pounds per square inch, an elongation of 2 per cent in 2 inches, a brinell of 75 and melts at 800 degrees Fahr. This alloy can be plated, weighs about the same as the other and its physical characteristics compare favorably with those of malleable iron.





(Right)—Tool and die department where the intricate dies for the die casting machines are made. (Below)—A view in the die casting department showing one of the casting machines. A gas-fired melting pot is employed.

The tin and lead-base alloys offer an extensive range of various type mixtures varying from cheaper antimonial-lead alloys to the high-speed tin-base babbitts. These alloys usually melt at around 400 degrees Fahr., but much higher or lower melting points can be secured by varying the

In the trimming department bandsaws are used for cutting off sprues and risers, while drill presses and special machines are provided to tap the cavities and holes

several components of the mixture.

The Alemite Die Casting & Mfg. Co. is widely known for its automobile, pressure greasing units which part of its business it sold out some time ago. It is still better known for the die castings it makes for a wide diversity of industries of which the automotive stands first. The company was started some 16 years ago and its present volume of business can be gaged partially by the fact it has more than 2000 active dies.

Will Make Cooking Utensils

Its Chicago plant has 75,000 square feet of floor space while the one in Woodstock contains 150,000 square feet. This latter plant is being fitted up for the manufacture of a full line of cast aluminum cooking utensils, which line is already in production at the Chicago plant. A special alloy, containing no ingredients injurious to the health, has been developed by the research department of this concern for these utensils.

In designing these utensils the metal body was made much thicker than anything similar now on the market. This affords the following advantages—retains heat longer, more uniform distribution of heat, less chance of burning food, and gives longer life. The handles are made of material which will not conduct heat.

All of the die casting machines used in this concern were developed, designed and built in a specially equipped machine shop at the Chicago plant. The type of machine used consists of a tank or reservoir containing the molten metal, a die just above the goose neck and a machine for operating the die and goose neck.

In operation the goose neck is submerged in the reservoir, filled with molten alloy and the nozzle end raised until it is pressed against the bottom of the die, the opening of the goose neck lining up with the opening in the die block. Air under pressure is then forced in at the other end of the goose neck and the hot metal forced up into the die. The die is then moved back, pulled apart and the casting dropped out. These dies are water cooled and in some of the larger machines the two parts are pressed together with a pressure of from 45 to 55 tons.

A hood drops around the machine as the metal is forced into the die. All of these operations are automatic and are performed in a fraction of a second at the touch of a button by the operator. One machine will produce close to a ton of castings in a 9-hour day, and one die is good for from 10,000 to 200,000 castings. The reservoir is of steel, setting on a brick foundation enclosing a combustion chamber in which are six gas burners. Fresh metal is added from time to time.

There are 35 of these machines in the die casting department and the reservoir capacity of each is approximately 1500 pounds. Some castings require a large number of steel or brass inserts or cores put in at all angles. In some cases it requires as high as 20 tons tension to pull these cores and yet they must be held in place and pulled automatically with the opening of the die.

This company has developed two ways of holding and pulling these cores, one requiring a fixture and the other working without a fixture. In the latter case the die is so prepared that the operator can easily insert the cores by hand. Occasionally, as many as 25 or 30 cores are used in a single casting.

The method of gating is of great importance because, due to the very high pressures used, the time occupied in filling the die cavity hardly can be measured in fractions of a second. For this reason it is necessary to so design the gate that the metal will flow freely and with no restriction and the least possible friction. It is also essential to so vent the dies that the air can quickly escape, but in such a manner that the metal cannot follow.

The air vents in the dies made at the plant are wide, but very shallow which allows the air to escape at the proper speed but causes the metal to freeze upon entering, thereby preventing the flow of any more metal. There has been developed here also a chemical which is washed on the face of the die to prevent a too rapid cooling of the metal when it strikes the surface of the die. This chemical forms an iron oxide which sufficiently retards the chilling action of the cold die.

Served with Hot Metal

The die casting machines are served with hot metal direct from the metal alloying department. Here are located 15 gas furnaces built of firebrick enclosing oval or round pots. Each pot has a capacity of 3 tons and is heated with 10 gas burners. The pots are cast from an acid and heat-resisting alloy developed by the research department. The molten metal is moved from these furnaces to the die casting machine in pots on trucks as needed and the rest pigged for storage.

Large groups of band saws are used in cutting off the sprues and gates. Drill presses and special machines are used in tapping cavities and holes. While it is possible to cast external threads, owing to the fact that the

metal shrinks more than the die and, therefore, freezes upon it, internal threads are rarely, if ever, cast. There are also long lines of burnishing and polishing machines, but the machining of these castings is so minimized that few machines are required for this purpose.

In addition to the die casting and metal alloying departments at this plant there are also the laboratory and research departments, tool and diemaking shop, trimming and machining, polishing and plating, packing and shipping and extensive machine shop in which all the machines used are built. For plating practically all platable metals are used here and recently a large chromium plating installation has been made. The tanks in this installation are all heated with gas.

One of the most important details in the making of the dies is the heat treatment given them to develop the physical properties so necessary in this kind of work. Unless a high grade of steel is used for the dies, and unless the heat treatment is properly handled, the surface will crack after several thousand castings have been made, and will produce a rough, streaky product. In this process gas fuel is used.

Open-Hearth Operators Meet in Chicago

The tenth semiannual conference of the open-hearth committee of the American Institute of Mining and Metallurgical Engineers was held in the Stevens hotel, Chicago, Nov. 5 and 6. Registration, the largest since the organization of the group 5 years ago, totaled 130.

The work of the committee has come to the attention of the English and German open-hearth operators and these foreign groups have expressed a desire to interchange ideas on steelworks' practice. Some plan may be evolved in the future.

Many subjects were discussed at the meeting including ingot mold size, furnace operation and construction. In speaking of ingot mold size, one open-hearth superintendent suggested a straight sided mold with a 1½ inch taper and a 1½ inch radius on the corner as an aid to reducing segregation in 25 x 40 inch rimming steel ingots. Molds 21 x 44 inches were cited as satisfactory.

Furnace control equipment was stamped as the most important problem facing open-hearth steelmakers. Little if any control equipment has been installed on open-hearth furnaces in this country during the past three years, according to the statement of one operator. Where automatic control has been installed, the equipment has had a material effect on the personnel. Moreover, costs have been reduced and a better grade of steel produced because of more accurate control. It was mentioned that furnace control equipment affords a reduction in the quantity of fuel used and in the volume of waste gases which in turn lessen scouring action on the outgoing furnace section.

One operator pointed out that one 100-ton open hearth in this country is equipped with indicating and recording instruments to help the operator maintain uniform conditions. The average fuel consumption for melting cold charges is 27 gallons of oil per ton of ingots. The hearth of the furnace is 36 x 14 feet and the time from tap to tap is 10 hours and 40 minutes.

Various trends in the steel industry, standardized practices and recommendations for discussion were presented by the chairmen of the various standing technical committees. The committee on furnace design brought out the fact that local conditions and type of product must be considered in discussing open-hearth furnace construction. The hearth should be of sufficient area and depth to permit rapid melting, but not so shallow as to cause excessive oxidation loss of the charge. The hearth area per ton of steel varies from 4½ to 6¾ square feet. The bottom usually is made up of 9 inches of clay brick laid on the steel pan, 9 inches of magnesite or chrome brick laid on the clay brick and 9 to 12 inches of sintered magnesite.

Various types and thicknesses of roofs are in use, according to the report. The usual thickness appears to be 12 inches for the center section. The rise of the arch varies from 22 to 30 inches. The height of the skewbacks above the sill plate ranges from 4 to 6 feet. Some plants have adopted an 18-inch roof, using 22-inch ribs. It is claimed a roof of this thickness affords a campaign of 400 heats in a basic furnace.

Construction of gas and air ports depends upon the kind of fuel used. The entire end of the furnace above the floor level should be considered because the manner of admitting the air and gas determines the rate of combustion. Regenerator capacity should be gained by increasing the depth rather than width, because the wide chamber has the disadvantage of not distributing the gases uniformly. The side walls and roof of the regenerators should be sealed against air infiltration and should be insulated to reduce heat radiation losses. Water-cooled doors and frames are used at most plants.

Many factors govern the making of quality steel, according to the report submitted by the quality control committee. High-grade iron was mentioned as one essential. To produce good quality steel, open-hearth furnace bottoms must be kept in good shape. Particular attention should be paid to the kinds of scrap that affect the charging rate per hour.

It is desirable to shut off the air a few minutes before the heat is tapped. This permits a softer flame and prevents the slag becoming thin. Moreover, removing the pressure in the furnace allows the steel to free itself of inclusions more readliy.

The report of the steel melting committee brought out the fact that various percentages of pig iron charged have a decided effect on open-hearth practice. Starting with a 45 per cent metal charge and increasing to 70 per cent, each 4 per cent increase within this range decreased production 1 per cent. For each 1 per cent increase in the metal charge, the cost of bottom material increased about 2 per cent. The amount of limestone charged per ton has an important bearing on production, cost and quality. Practice shows that increasing the limestone charge from 10 to 12 per cent does not materially benefit the quality of steel. In fact, increasing the stone in the charge from 8 to 11 per cent decreased the output of steel 1 per cent for each one-half per cent increase in the limestone added. The life of the roof was lowered and the cost of repairs increased, due to the extra heat required to bring up the lime.

Equipment Orders Rise

The index of gross orders for foundry equipment for October was 245.3 as compared with 216.3 for September, according to a recent report of the Foundry Equipment Manufacturers' association. The index of shipments for October was 214.1 as compared with 176.8 for September. Unfilled orders for October were 492.5 against 480.8 for September. The base is the average monthly shipments for the years 1922-23-24. Comparison of monthly orders as presented by the association follow:

Month	1926	1927	1928	1929
Jan.	168.2	180.4	132.7	180.5
Feb.	154.9	198.0	123.6	197.0
March	157.3	131.1	138.6	209.4
April	113.2	130.0	107.7	172.6
May	128.5	134.8	335.6	177.7
June	133.5	138.4	149.1	177.3
July	127.3	89.9	94.8	219.3
Aug.	141.2	106.4	278.0	229.5
Sept.	114.0	80.4	170.0	216.3
Oct.	140.5	98.0	185.0	245.3
Nov.	133.4	95.8	197.8	.....
Dec.	181.0	106.8	166.5	.....

He Was Born Under the Sign *of Sagittarius*

THERE it is in Spanish for any one to see, *Fundicion De Bronce Miller*. For the benefit of those who are not blessed with a knowledge of this sweetly flowing tongue, it is known as the Miller Brass Foundry with H. H. Miller, proprietor. All this in the city of Torreon, state of Coah., which of course every one knows is an abbreviation for Coahuila, one of the 30 states into which—unlike the three-way split in ancient Gaul—Mexico is divided.

How come—the inquiring reader quite properly asks at this point—how come this decidedly Anglo-Saxon Senor Miller is found so far south of the Rio Grande? Quite true Coahuila is a border state, but Torreon is a long way from the United States border on the north and only a little way from the border of the neighboring Mexican state of Durango on the west, and Durango, as the steady newspaper reader knows, is one of the favorite proving grounds for revolutionists. The Ins and the Outs clash here at the beginning of every revolution. Down there our famous "As Maine goes, so goes the Nation" becomes "Durango decides who shall rule Mexico."

All these things do not disturb Senor Miller. He minds his own business—an excellent practice in any country—and makes brass castings for all and sundry either in periods of peace or war. He does not align himself with any party, but sticks closely to the middle of the road. As a result he has not been disturbed by either federal or revolutionary troops in any of the many movements which carried them through Torreon. During one particularly dark and gory period when every foreign inhabitant had left the city either by desire or by request, he alone was allowed to remain.

He speaks Spanish as readily as the mother tongue he learned in the state of Illinois where he was born in a pioneer's log house in 1876. Horoscopes cast for embryo citizens born in log cabins in the middle West invariably swing as if on a pivot, until they point to the mountains of gold and the mountains of power in the East. How then—this question previously unanswered—how then do we find H. H. Miller, born of pioneer stock in the middle West, how do we find him proprietor of an extensive brass foundry in the Mexican city of Torreon where he also has maintained a comfortable bachelor establishment for the past 20 years?

Mis Amigos, 'tis a long tale and a true tale and a thirsty tale and the only regrettable feature in the retailing of it is that you cannot hear it at Senor Miller's hospitable board where suitable materials and appliances always are available for the alleviation of those in need of alleviation. Also where proper attention could be given to the thousands of intimate details connected with a journey beside which the much touted adventures of Ulysses are no more than an afternoon's trip to Coney Island down the bay.

Sense of duty held wanderlust in check while H. H. was going through a village high school and clerking for three years in a hardware store. The barrier was broken down when an old schoolmate came through the town on his way to stake a claim in Mississippi with four mules, a big wagon and a saddle horse. H. H. flew away with him and that was the beginning of a hegira that carried him over all the southern, southwestern states and a great part of Mexico during the following 15 years.

Old King Cotton had the benefit of his services for several years and his knowledge of this business brought him to the attention of a get-rich-quick-Wallingford gentleman at that time operating out of Mexico City. This citizen had vast schemes for converting Mexico into the cotton supply center of the world. He was to supply the brains, the energy and the money (other people's) and he engaged H. H. to attend to the technical supervision of the enterprise when and if it was started. This arrangement brought our hero to Torreon where a slight hiatus in the matter of arrears in salary caused him to seek employment in the local foundry.

The vast interlocking of banker's associations and—well, one thing and another—induced the agile Mr. Wallingford to take a trip to Europe and his local associates promptly moved a vote of lack of confidence and gobbled up the works. H. H. saw his glimpses of vast wealth go glimmering, but by this time he had another arrow in the quiver. In company with the foreman of the foundry he started a small brass shop. He furnished the money and the other lad furnished the experience with the usual result that in a couple of years he had the experience and the other lad had spent all the money.

A trifle like that is all in the day's work. H. H. reorganized better and bigger and for the past eight or nine years has been operating as nice a brass shop as you would find in many a day's journey. Some day perhaps, Sagittarius the Archer—under whose sign he undoubtedly was born—will drop another arrow in the quiver and then—*quien sabe?*

The Shakeout

DAN M. AVEY, *Editor*
FRANK G. STEINEBACH, *Managing Editor*
PAT DWYER, *Engineering Editor*
EDWIN BREMER, *Metallurgical Editor*
CHARLES VICKERS, *Nonferrous Editor*
NORMAN F. HINDLE, *Assistant Editor*

¶ Leads the Way

KEEN interest was evinced in the Stevens type open-hearth furnace in use at the Laclede Steel Co., Alton, Ill., by the members of the open-hearth committee of the American Society of Mining and Metallurgical Engineers who visited the plant. It is gratifying to note that the first furnace of that type that was built was installed in one of the large steel foundries in the Chicago district. The first description of the operation and construction was carried in the June 15 and July 1 issues of THE FOUNDRY.

EASE of control is one of the main advantages of this type furnace. Steel foundrymen, always on the lookout for improving their product, realized long ago the necessity for more accurate control of furnace conditions. Steel for casting must be of the highest quality attainable for no opportunities are available for working the metal as is the case in other steel industries. By adopting furnace control in both electric and open hearth practice to increase the quality of their product and to reduce production costs, steel foundrymen have shown the way to the steel industry.

¶ Tariff Tinkering

IN THE tariff bill, which has been the stumbling block for the special session of Congress and which probably will require considerable attention at the regular session opening Dec. 2 foundrymen again are threatened with an increase in the cost of foundry facings and crucibles, due to changes made to the duty on graphite. Unless sufficient interest is shown by users of graphite and plumbago to secure a further hearing on this item, Senator Black of Alabama will be successful in saddling an additional burden upon users of graphite in a futile effort to protect a domestic industry which is not in a position to supply the quality of graphite necessary for foundry facings and crucibles.

AS WAS pointed out to the ways and means committee and the Senate finance committee, it will be necessary for manufacturers of foundry facings and crucibles to import graphite, regardless of the duty imposed. Studies made by manufacturers, information revealed in governmental reports on the quality of domestic graphite, and experience acquired during the war, when a shortage of imported material necessitated the use of the domestic product, all show that practically none of the graphite produced in the United States is suitable for crucibles and facings. To obtain satisfactory results, manufacturers have been forced to import graphite in the face of much higher costs.

FAILURE of the special session to pass the tariff bill offers a splendid opportunity for further consideration of the subject. Complete information should be presented to the Senate to show the necessity of importing graphite, duty or no duty. Congress should place the item on the free list, or at least allow the schedule to remain as it was before the tariff tinkering started.

¶ Extend Your Knowledge

WHAT foundryman has not heard the instructions, "Give us a good, strong iron for those castings, but see that it is easy to machine"? How many times has he had castings returned when he ventured to meet these requirements, because the machine shop claimed they were too hard? In the majority of instances, the whole trouble was that the castings were tough—and *not* hard. This condition is the natural result of refining the grain structure through the various means at the foundryman's command. However, no distinction is made in the machine shop between really hard iron, and that which is tough. When the tool fails to cut the casting like a dull knife does cheese, the cry of hard iron arises.

WHILE the foundryman has enough to keep him busy in trying to keep in touch with his own field, it may repay him to gather some knowledge about machining. This does not mean that he should become an expert machinist, but he can learn about proper machining speeds, tool steels, and the way to grind the tools for the best results. With the background of this knowledge, the foundryman confidently can walk into the consumer's machine shop, and point out that through proper machining methods, previous difficulties may be eliminated. This ability not only will protect him from needless expense, but will give him an added strength in that he knows whereof he speaks.

Comings and Goings of Foundrymen

Men of the Industry, Whose Activities Are Making Foundry History

S. C. VESSY, president, W. W. Sly Mfg. Co., Cleveland, has been elected a director of the American Foundrymen's association to fill the vacancy caused by the death of H. Cole Estep. Mr. Vessy was born at Warren, O., in 1866 and received his education in the public schools of Ohio, at Western Reserve seminary and Grand River institute. After completing a course in law,

S. C. VESSY

he was admitted to the Ohio bar in 1891. At that time he removed to Cleveland, where he engaged in the general practice of law for about 25 years, representing many manufacturing and industrial organizations, including the W. W. Sly Mfg. Corp. Following the death of Mr. Sly in 1920, Mr. Vessy was selected as president of the Sly corporation. Mr. Vessy has been active in the affairs of the American Foundrymen's association for a number of years. He served on the exhibits committee in 1925-26 and was a member of the board of directors from 1926 to 1929.

Bertha Campbell has been made treasurer and director of the Western Aluminum Foundries, Oakland, Calif.

J. E. Edds, formerly general superintendent, Goulds Pumps Inc., Seneca Falls, N. Y., now is superintendent of No. 2 plant. Nelson B. Delavan, formerly assistant general manager is now merchandising manager. Hamilton Garnsey, formerly foundry engineer, is now assistant to the general manager.

R. S. Davis, formerly plant engineer of the Indianapolis plant, National Malleable & Steel Castings Co., has been appointed assistant manager.

David McLain, McLain's System, Inc., Milwaukee, will speak before the foundry section of the Foreman's Safety school, Milwaukee, on Dec. 11.

A. L. McColloum has been appointed sales agent of the Indianapolis plant of the National Malleable & Steel Castings Co., to succeed S. C. Wasson, recently appointed plant manager.

Norman Leonhard, for nine years superintendent of the pattern department of the Kissel Motor Car Co., Hartford, Wis., has resigned to become active in the ownership and management of the Waukesha Pattern Works, Waukesha, Wis.

Stowell C. Wasson, formerly sales agent, Indianapolis plant, National Malleable & Steel Castings Co., has been appointed manager of the Indianapolis plant to succeed Carl C. Gibbs, recently appointed assistant to the president. Mr. Wasson has been employed by the company since 1910. He has been in the sales department since 1919 and was made head of that department in 1921.

Fred Stiehl has resigned his position with the International Harvester Co., McCormick Works, Chicago, to accept a position as superintendent with the Malleable Iron Fittings Co., Branford, Conn. Mr. Stiehl prior to his connection with the Harvester company was associated with the Globe Malleable Iron & Steel Co., Syracuse, N. Y., Vermillion Malleable Iron Co., Hoopeston, Ill., and the Peoria Malleable Castings Co., Peoria, Ill.

Carl C. Gibbs, for the past nine years manager of the Indianapolis plant, National Malleable & Steel Castings Co., has been transferred to Cleveland as assistant to the president. Mr. Gibbs has been associated with the National company for 23 years. He started his career in Indianapolis in 1906 and remained there until 1919, when he was transferred to Cleveland as sales agent. He returned to Indianapolis in 1920 as plant manager. Mr. Gibbs was born in Rush county, Indiana, and was graduated from Shortridge high school, Indianapolis. He was prominent in civic affairs in that city.

Dan M. Avey, editor of THE FOUNDRY, Cleveland, has been appointed by President Fred Erb to the chairmanship of the American Foundrymen's association's committee on international relations, filling the vacancy left by the death of the former chairman, H. Cole Estep. Mr. Avey was a member

Photo Blank & Stoller
DAN M. AVEY

of the American party which attended the Third International Foundrymen's congress in London in June of this year. For many years he has been an active member of the association. He has served on a number of committees and at present is chairman of the committee on program and papers. The committee on international relations acts for the A. F. A. in connection with the International congresses which are held at three-year intervals.

S. H. Slaymaker, of Fairbanks, Morse & Co., Beloit, Wis., has been appointed in charge of the metals and foundry section of the annual Rock River valley safety conference to be held at Madison, Wis., on May 6, 1930.

Ralph M. Hill, president and manager of the East St. Louis Castings Co., East St. Louis, Ill., is one of the new directors of the Gray Iron institute. Mr. Hill was graduated from

Purdue university, Lafayette, Ind., in 1907 and entered the employ of the National Malleable & Steel Castings Co., Indianapolis. He resigned that position to accept one with the General Electric Co. at the Erie, Pa., plant. Later he was connected with the Standard Malleable Iron Co., Muskegon, Mich., and the Missouri Malleable Iron Co., East St. Louis, Ill. In 1920 when the East St. Louis Castings Co. was organized Mr. Hill became president and manager of the new company.

R. J. McSherry, formerly general superintendent, Oliver Chilled Plow Works, South Bend, Ind., has been appointed foundry superintendent of the Studebaker Corp., South Bend, Ind. Prior to his connection with the Oliver company, Mr. McSherry was associated with the Stover Mfg. & Engine Co., Freeport, Ill., where he served his apprenticeship and rose to be assistant foundry superintendent. He was with the company from 1911 to 1913, when he left to become foundry manager of the Hercules Corp., Evansville, Ind. Mr. McSherry remained with that company until 1923, when he accepted a position as foundry sales engineer for the Hillside Fluor Spar Mines, Chicago. The following year he re-entered the active foundry field as general foundry superintendent of the Oliver Chilled Plow Works, South

R. J. McSHERRY

Bend, Ind., which position he occupied until his recent appointment. Mr. McSherry was born at Rockford, Ill., in 1888, and received his advanced education at the University of Wisconsin.

Organized 25 Years

In 1904, just 25 years ago, Thomas W. Pangborn and John C. Pangborn, organized the Pangborn Corp., Hagerstown, Md., for the production of sandblast and dust collector equipment. In honor of that occasion, that company has issued a folder telling of the growth of the firm and showing some of the installations which it has made. The folder is entitled, "The Quarter Century Mark" and contains a brief history of the company.

Opens St. Louis Office

Frank P. Walsh has been placed in charge of a new office recently opened by the Whiting Corp., Harvey, Ill., at 1442 Syndicate Trust building, St. Louis.

Mr. Walsh has been connected with the estimating and sales departments of the Whiting Corp., for about 14 years. He will have charge of the territory which includes Southern Illinois, Missouri, Arkansas, Oklahoma, Western Iowa and Nebraska.

Foundry Association Directory

American Foundrymen's Association

President, FRED ERB, Erb-Joyce Foundry Co., General Motors building, Detroit; executive secretary treasurer, C. E. HOYT, 222 West Adams street, Chicago; technical secretary, R. E. KENNEDY, 222 West Adams street, Chicago.

Associated Brass Founders of New England

President, J. A. DUNCAN, Wm. Duncan & Sons Co., 166 Liverpool street, East Boston, Mass. Meeting the fourth Wednesday of each month at the Engineers' club, Boston.

The Buffalo Foundrymen

President, J. MCARTHUR, Washington Iron Works; secretary, W. J. WARK, E. J. Woodison Co., 140 Chandler street. Meetings each month at club rooms, 140 Chandler street.

Central Illinois Foundrymen's Club

President, H. M. HIRE, Hire Foundry Co., Peoria, Ill.; secretary, FRANKLIN WHITEHEAD, The Meadows Mfg. Co., Bloomington, Ill.

Chicago Foundrymen's Club

President, H. P. EVANS, Pettibone-Mulliken Co.; secretary, ALBERT N. WALLIN, S. Obermayer Co., 2563 West Eighteenth street. Meetings first Thursday in each month at the City club, 315 Plymouth court.

Connecticut Foundrymen's Association

President, CARL S. NEUMANN, Union Mfg. Co., New Britain, Conn.; secretary CHARLES S. PARKER, Charles Parker Co., Meriden, Conn. Meetings are on second Friday of each month in various parts of the state.

Detroit Foundrymen's Association

President RUSSELL M. SCOTT, Packard Motor Co., Detroit; secretary, WILLIAM J. MUHLITNER, Great Lakes Foundry Sand Co., Detroit. Meetings third Thursday in each month at appointed place.

East Bay Foundrymen's Association

Secretary O. R. MOLLER, Electric Steel Foundry Co. Inc., 1328 Second street, Berkeley, Calif.

Gray Iron Institute

President, WALTER L. SEELBACH, Forest City-Walworth Run Foundries Co., Cleveland; Secretary, ARTHUR J. TUSCANY, Terminal Tower building, Cleveland.

Malleable Iron Research Institute

President, R. R. FAUNTLEROY, Moline Malleable Iron Co., St. Charles, Ill.; secretary ROBERT E. BELT, Union Trust building, Cleveland.

Metropolitan Brass Founders' Association

President WILLIAM EMBER, Jefferson Brass Foundry, 62 Delevan street, Brooklyn, N. Y.; secretary, WILLIAM E. PAULSON, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meeting second Wednesday in each month at the Building Trades club, 2 Park avenue, New York.

Newark Foundrymen's Association

President, J. L. CARTER, Sachs-Barlow Foundries Inc., Newark; secretary W. H. MANTZ, Atlas Foundry Co., Irvington, N. J. Meeting called by president.

New England Foundrymen's Association

President CARL S. NEUMANN, Union Mfg. Co., New Britain, Conn.; secretary, FRED F. STOCKWELL, 205 Broadway, Cambridgeport, Mass. Meetings second Wednesday of each month at the Exchange club, Boston. Outings usually are held in the summer months.

Ohio Foundries Association Inc.

President, DON MCDANIEL, Hamilton Foundry & Machine Co., Hamilton, O.; secretary-manager, E. F. SCOTT, 418 Penton building, Cleveland.

Philadelphia Foundrymen's Association

President, C. F. HOPKINS, Ajax Metal Co., Philadelphia; secretary EARL SPARKS, 1623 Sansom street, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Pittsburgh Foundrymen's Association

President, L. W. MESTA, Mesta Machine Co., Homestead, Pa.; secretary-treasurer WILLIAM J. BRANT, Wm. J. Brant, Bessemer building, Pittsburgh. Meeting on the third Monday of the month, except in July and August at Fort Pitt hotel.

Quad-City Foundrymen's Association

President, F. W. KIRBY, John Deere Spreader Works, East Moline, Ill.; secretary-treasurer, J. P. BOADEN, Union Malleable Iron Co., East Moline, Ill. Meetings the third Monday of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

St. Louis District Foundrymen's Club

President, HORACE R. CULLING, Carondelet Foundry Co., St. Louis; secretary-treasurer, LEO J. FILSTEAD, John C. Kupferle Foundry Co., St. Louis.

Southern Metal Trades Association

President, JOHN S. SCHOFIELD, J. S. Schofield's Sons Co., Macon, Ga.; Secretary, W. E. DUNN JR., Flatiron building, Atlanta, Ga.

Steel Founders' Society of America

President, J. E. MCCAULEY, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.; managing director, G. P. ROGERS, Graybar building, New York. Meetings: William Penn hotel, Pittsburgh, Dec. 12 and Cleveland, May 12-15, 1930.

Tri-City Technical Council

Chairman, C. F. SCHERER, Davenport Machine & Foundry Co., Davenport, Iowa; secretary, E. C. XANDER, assistant secretary, Tri-City Manufacturers association, Moline, Ill. Combined meetings held only one or two times a year on call.

Tri-State Foundrymen's Association

President, WILLIAM HOPPENJANZ, The Star Foundry Co., 221 Main avenue, Covington, Ky.; secretary, GEORGE W. PIEHL, Weising Bros. Foundry Co., 1607 McLean avenue, Cincinnati. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

Twin City Foundrymen's Association

President, R. D. BONNEAU, Commutator Co., Minneapolis; secretary-treasurer, C. E. LANGDON, 3849 Lyndale avenue, south, Minneapolis. Meeting third Wednesday of each month at Athletic club.

Washington Foundrymen's Club

President, J. W. ORPHAN, Lake Union Foundry Co., 1703 Westlake avenue, Seattle; secretary, EDWARD C. GUSTIN, The Prescott Co., 1 West Lander street, Seattle. Meetings second and fourth Tuesdays of each month at the Elks Temple, Fourth avenue and Spring street.

Obituary

W. E. Gerlinger, president, Gerlinger Brass & Aluminum Foundry Co., Milwaukee, died recently. Mr. Gerlinger was born at Marysville, Kans., on Aug. 30, 1874 and went to Milwaukee with his parents while a boy. In 1902 he was one of the organizers of the Shaw-Gerlinger Foundry Co., Milwaukee, makers of gray iron castings. In 1903 the business was changed to the manufacture of crucible steel castings and the name of

W. E. GERLINGER

the firm was changed to the Tobin-Gerlinger Casting Co. In 1906 the name of the firm was changed again to the Gerlinger Steel Casting Co. That company continued to manufacture crucible steel castings until 1914 when it installed one of the first electric furnaces in the northwest. In 1919 Mr. Gerlinger organized the Gerlinger Electric Steel Foundry Co., which was merged with the Gerlinger Steel Casting Co. to form the Gerlinger Electric Steel Casting Co. Mr. Gerlinger was president of that company until 1927 when it was sold to Kearney & Trecker Corp., Milwaukee. He and his brother then organized the Gerlinger Brass & Aluminum Foundry Co., of which he was president at the time of his death.

Warren E. Mumford, metallurgist, Malleable Iron Fittings Co., Branford, Conn., died Nov. 15.

David Van Schaack, founder and twice president of the National Safety Council, died Nov. 12 at Hartford, Conn., at the age of 61 years.

Lester S. Carroll, 53 years old, vice president in charge of purchases since 1924 of the American Locomotive Co., New York, died Nov. 14, on a subway train in that city. Prior to his election as vice president, Mr. Carroll had charge of the company's general purchases since March, 1920. He was one of the most widely known railroad men in the United States.

Steel Founders' Society Schedules Meetings

Pittsburgh has been selected for the next regular meeting of the Steel Founders' Society of America on Dec. 12. Plans also are being completed for a regular meeting of the society in Cleveland in the week of May 12, 1930, during the American Foundrymen's association convention. The latter meeting will be directed by John E. Galvin, Ohio Steel Foundry Co., Lima, O., vice president and chairman of the central division of the society.

Chicago Club Discusses European Practice

General foundry conditions in Europe, and metallurgical observations obtained last June in foundries abroad, at the time of the third International Foundrymen's congress in London, were presented by several speakers to more than 100 members of the Chicago Foundrymen's club Thursday evening, Nov. 7, at the City club, Chicago. This was one of the largest meetings of the year for the Chicago club.

S. T. Johnston, S. Obermayer Co., Chicago, past president of the American Foundrymen's association, Fred Erb, Erb-Joyce Foundry Co., Detroit, president of the association, and C. E. Hoyt, Chicago, executive secretary, discussed general European foundry conditions and phases of the trip. R. S. MacPherran, chief chemist, Allis-Chalmers Mfg. Co., Milwaukee, reviewed metallurgical progress of British, French and German foundries, and displayed sample castings produced in the foreign plants. R. E. Kennedy, vice president of the American Foundrymen's association, discussed technical control and labor developments in the overseas foundries. A large number of questions were asked the speakers by members of the club.

Mr. Hoyt paid a warm tribute to the late H. Cole Estep, vice president of the Penton Publishing Co., Cleveland, for the latter's part in helping to organize the international foundrymen's meetings. Mr. Estep was an active member of the Chicago Foundrymen's club from 1910 to 1914. The club voted to appoint a representative to report activities of the local club to the American Foundrymen's association headquarters. This American Foundrymen's association representative will be named by President H. P. Evans, of the Chicago club.

Lee Farrell Is Dead

Lee R. Farrell, secretary, treasurer, sales manager and director of the Industrial Silica Corp., Youngstown, O., died Monday night, Nov. 18, at Tucson, Ariz., of nephritis. Mr. Farrell was 45 years old and had been connected with the Industrial Silica Corp. and its predecessor, the Portage Silica Sand Co. since 1914. Previous to the latter connection, he was associated with the Homestead works of the Carnegie Steel Co., and later with the First National Bank of Youngstown.

Photo Blank & Stoller
LEE R. FARRELL

Issues Safety Folder

Mine Safety Appliances Co., Pittsburgh, has issued a folder entitled "Practical Aspects of Resuscitation" by Edward Steidle, dean, school of mines and metallurgy, Pennsylvania State college, State College, Pa. The booklet gives a short discussion on respiration and describes the functions of the respiratory organs. Asphyxiation from various causes is discussed, together with artificial respiration, its history, and the Schaefer and Sylvester methods. The latter part of the booklet is devoted to descriptions of different resuscitation apparatus.

National Founders Meet

(*Concluded from Page* 1000)

done by the Malleable Iron Research institute and previously by the organization when it was known as the American Malleable Castings association. An early step of the malleable industry was to establish a basis of comparisons. Members were sent a blueprint of a casting from which to figure weights and the divergence between the high and low estimates spanned more than 100 per cent. This showed the need for comparative methods. A sub-committee of the institute composed of plant cost accountants met and adopted uniform practices, but difficulty was experienced in bringing the individual plants to adhere to these practices. It is necessary in securing co-operation on a standard cost system that the management in every instance should be sold on the merits and need for such a system.

James L. Wick Jr., Falcon Bronze Co., Youngstown, O., spoke of the effort which has been made through the American Foundrymen's association to obtain response from brass foundries on the study of costs. The group idea, that is the study of comparative costs, submitted in such a manner as not to be identified with any one firm, is being followed by a group of brass foundrymen in the area between Chicago and St. Louis.

E. H. Ballard, General Electric Co., West Lynn, Mass., stated that a cost system to be effective should permit the office to bill the customer, whether it be an outside purchaser or the company itself, by each individual pattern. He stated that foundries which adhere to a class cost system are "kidding themselves." Since the first of January every casting in his plant has been billed on a pattern number, in other words on a piece-price basis, and class costs are used only to establish averages as a check.

C. S. Neumann, Union Mfg. Co., New Britain, Conn., called attention to the importance of such items as sorting, snagging and general cleaning which in gray iron castings may amount to as much as 2 cents a pound. The Connecticut Foundrymen's association, of which Mr. Neumann has been president, has provided an outline cost system in which each plant may fill in its particular items.

S. W. Utley, Detroit Steel Castings Co., Detroit, emphasized the error of selling castings on a pound basis. He reminded foundrymen that they are selling castings and not metal or any other bulk commodity. The casting represents the product of an art and the labor involved is more than 50 per cent of the cost. A good cost system should tie in with the books and if properly set up it will furnish backbone to the selling department to such a degree that castings will be sold by the foundries instead of being purchased by the customer. In commenting further on Mr. Utley's remarks Mr. Ballard stated that cleaning and finishing costs form an exception and are figured on a tonnage basis, but under a classification of 20 separate items which are time studied to assure accuracy.

In closing, Chairman Carter affirmed the previous statements that direct labor and individual piece-price costs are essential and emphasized the value of standardized costs in preventing the first steps toward price cutting.

RALPH H. CLORE

Kindly and understanding supervision in industrial plants is the outstanding requisite in increased production, according to Elton Mayo, professor of industrial research, Harvard university, graduate school of business, Cambridge, Mass., who spoke Thursday morning. This conclusion is based on an experiment now being conducted by Professor Mayo at a leading industrial plant, which experiment he described by aid of charts. The experiment, now nearing the end of its third year, deals primarily with a group of five girls in an assembly department and which recently has been extended in certain of its fundamental principles to more than 5000 of this particular companies employes, with little or no change in the tentative conclusions drawn.

Selling was discussed by R. C. Borden and Alvin C. Busse, professor, public speaking, New York university, New York. Declaring that a thorough knowledge of product and its field was the prime essential, the speakers proceeded to enumerate six primary principles of selling. At the closing session resolutions of respect were adopted in memory of O. P. Briggs, Milwaukee, and Mathew Griswold, Erie, Pa., who died during the past year.

Committee on Safety in Foundries To Meet

Foundry research committee of the National Safety council will meet in December to formulate plans for its activities during the coming year. The committee will be enlarged and will attempt to develop information that will be productive of better accident records. It was brought out at the recent safety congress that improvement had been made by foundries in their accident records for 1928.

Made Sales Manager

Ralph H. Clore has been appointed general sales manager of the United States Electrical Tool Co., Cincinnati, succeeding George M. Lawrence, who has resigned to become vice president of the General Radial Drill Co., Cincinnati. Mr. Clore became connected with the sales department of the United States Electrical Tool Co. in 1927. Previous to that time he was associated with the National Carbon Co., Cleveland.

Stoughton Given Medal

Bradley Stoughton, head of department of metallurgy, Lehigh university, Bethlehem, Pa., was the recipient of the Grasselli medal at a presentation dinner in his honor, given by the American section of the Society of Chemical Industry, Nov. 8. The presentation speech was made by B. D. Saklatwalla, chief metallurgist and vice president, Vanadium Corp. of America, Bridgeville, Pa. Mr. Stoughton's acceptance speech dealt with materials for aircraft construction.

The occasion was a joint meeting in which the American Chemical society, the Societe de Chimie Industrielle and the American Electro-chemical socity also participated. It was held in Rumford Hall, New York.

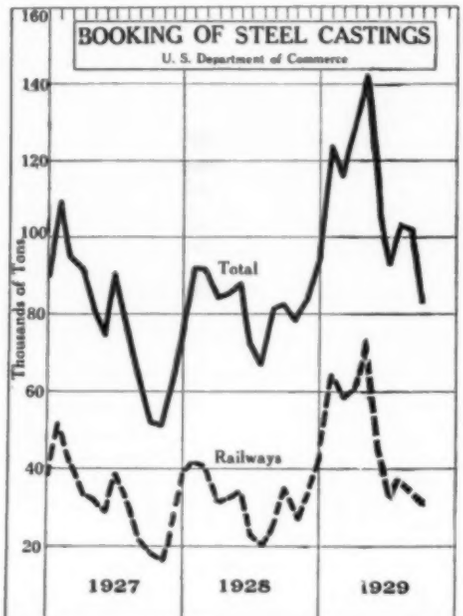
Refined primary lead produced in the United States during 1928 was 626,202 short tons valued at $72,639,000. During this period 311,000 short tons of secondary lead valued at $36,076,000 was produced.

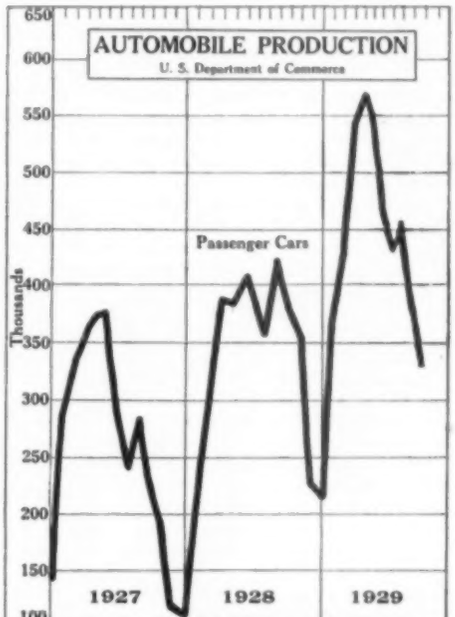
Trade Trends in Tabloid

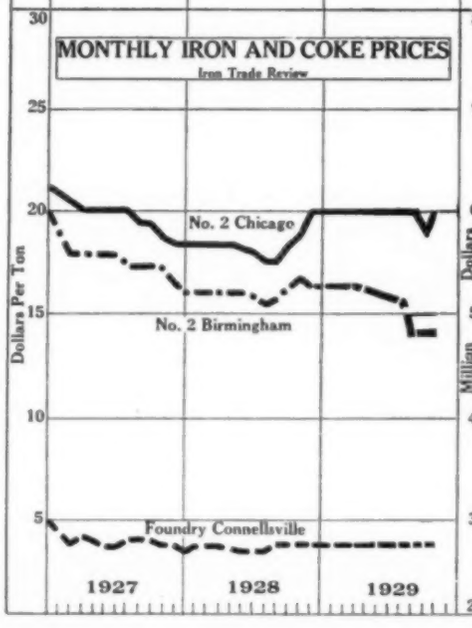
THE foundry industry in general has not been affected by the recent crash in the stock market. Jobbing foundries specializing in automotive work are operating at 50 per cent of capacity, which is normal for the season immediately preceding the series of automobile shows. Jobbing foundrymen are taking the opportunity to revamp and repair equipment, after one of the best years in history, and expect good business to follow in 1930. Railroads are buying considerable equipment including rolling stock and have promised President Hoover to spend $1,000,000,000 for capital improvements in 1930. Steel foundries in the Pittsburgh district have six months backlog orders on hand from steel mills and the railroads. Jobbing shops in the New England and Philadelphia sections are operating at a high rate for this period of the year. Building construction is on the upgrade and it is thought that much of the cash withdrawn from Wall street now will be available for furthering building programs. Cast iron pipe manufacturers feel that the present lull is only temporary and that municipalities will be in the market for spring needs soon. Orders for malleable castings increased in October over September, and production also showed a gain. Reports indicate that nonferrous foundry operations have dropped slightly from the rate experienced a few months ago.

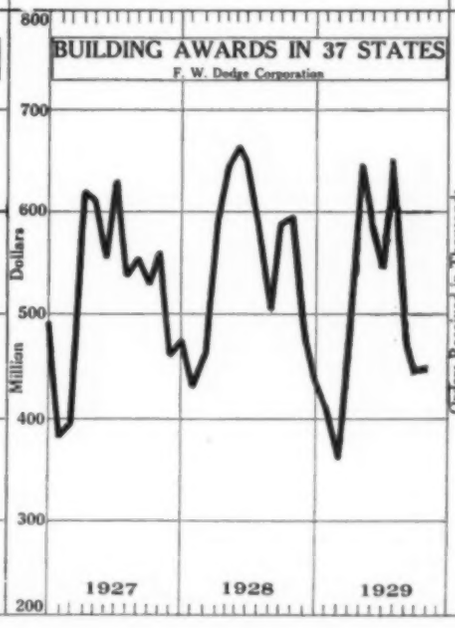
RAW MATERIAL PRICES
Nov. 21, 1929

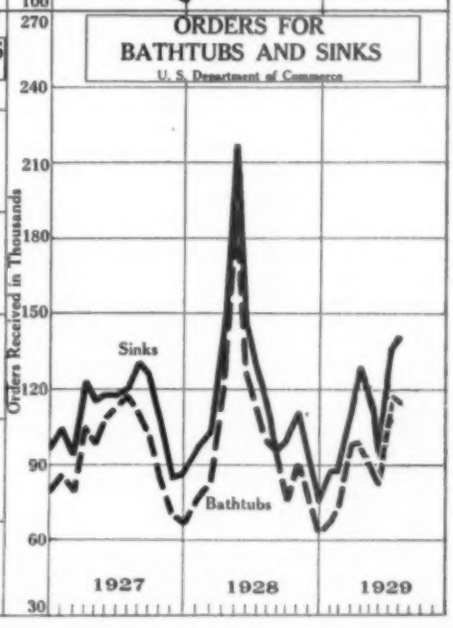
Iron	
No. 2 foundry, Valley	$18.50
No. 2 southern, Birmingham	14.50
No. 2 foundry, Chicago	20.00
No. 2 foundry, Philadelphia	21.76
No. 2 foundry, Buffalo	19.50
Basic, Valley	18.50
Basic, Buffalo	18.50
Malleable, Chicago	20.00
Malleable, Buffalo	20.00
Coke	
Connellsville beehive coke	$3.50 to 4.85
Wise county beehive coke	4.25 to 5.00
Detroit by-product coke	8.50 to 9.00
Scrap	
Heavy melting steel, Valley	$15.50 to 16.00
Heavy melting steel, Pitts.	15.50 to 16.50
Heavy melting steel, Chicago	12.50 to 13.00
Stove plate, Buffalo	12.50 to 12.75
Stove plate, Chicago	10.50 to 11.00
No. 1 cast, New York	12.00 to 12.50
No. 1 cast, Chicago	14.00 to 14.50
No. 1 cast, Philadelphia	16.00
No. 1 cast, Pittsburgh	15.00 to 16.00
No. 1 cast, Birmingham	12.00 to 13.00
Car wheels, iron, Pittsburgh	15.00 to 15.50
Car wheels, iron, Chicago	13.50 to 14.00
Railroad malleable, Chicago	15.75 to 16.25
Malleable, Buffalo	17.50 to 18.50
Nonferrous Metals	**Cents per pound**
Casting, copper, refinery	17.00
Electro, copper, producers	18.00
Straits tin	41.00 to 41.25
Lead, New York	6.25
Antimony, New York	8.50 to 8.62½
Nickel, electro	35.00
Aluminum, No. 12, producers	23.00
Aluminum, No. 12, remelt	17.00 to 17.50
Zinc, East St. Louis, Ill.	6.20











What the Foundries Are Doing

Reflecting the Activities of the Gray Iron, Malleable, Steel and Brass Shops

Vanott Machine Corp., Buffalo, foundry operators has been incorporated with $75,000 capital, by H. Horowitz, attorney, Ellicott square.

The foundry owned by Oscar Morris at 158 Marion street, Oshkosh, Wis., recently was damaged by fire to the extent of $2000.

Geo. W. Grimes Co., Bluffton, Ind., operator of a foundry and machine shop, reports business good.

Traction Foundry & Machine Co., LaPorte, Ind., began operations on Nov. 4. (Noted Oct. 1.)

Northern Malleable Iron Co., Wells and Forest streets, St. Paul, has awarded a construction contract for a 1-story plant addition.

Keystone Foundry Co., Essex street and Wortman avenue, Brooklyn, N. Y., has plans prepared for two 1-story foundry additions.

New equipment is being installed at the Springfield, O., plant of the National Foundry & Furnace Repair Co., Dayton, O. (Noted Nov. 15.)

Lebanon Steel Foundry Co., Lebanon, Pa., has awarded a contract for a 1-story foundry addition, 183 x 260 feet, to the C. H. Foulkrod Co., Philadelphia. (Noted Nov. 15.)

Kalamazoo Stove Co., Kalamazoo, Mich., reports that its business for October was the largest for any corresponding month in the company's history.

International Steel Corp., Canton, O., which leased the plant of the Canton Steel Foundry Co., has remodeled the building and expects to begin production soon. (Noted Oct. 1.)

Acme Foundry Co., Second street and Cummings avenue, Superior, Wis., reports a large business in stove castings. Emmett Wilson is president.

Robbins & Myers Inc., Springfield, O., is building a new addition to its foundry. New equipment including a cupola will be installed in the new section.

Directors of American Steel Foundries, 410 North Michigan avenue, Chicago, have approved substantial expenditures for plant improvements and additions.

Haynes Stellite Co., Kokomo, Ind., manufacturer of alloys, tools, etc., has awarded several contracts in connection with its new plant addition. (Noted Nov. 15.)

Pacific Foundry Co., Eighteenth and Harrison streets, San Francisco, is said to have plans for the construction of a foundry addition.

The foundry of Cunningham & Son's St. Catherines, Ont., general jobbing and manufacturing, Berryman avenue was damaged by fire recently. Estimated loss is about $10,000.

Stannus Propeller Corp., 3401 Illinois street, Detroit, has been incorporated with $22,000 capital to operate a general machine shop, foundry and manufacturing business, by William Stannus.

Hubley Mfg. Co., Lancaster, Pa., has been incorporated with $5000 capital to manufacture and deal in metal toys, castings and metal products. Joseph T. Breneman, R.D. No. 6, Lancaster, is treasurer.

Andes Inc., Lancaster, Pa., has been incorporated with $50,000 capital to manufacture and deal in castings, tools and metal specialities. William D. Andes, Lancaster, is treasurer.

Motor-Car Ventilator Corp., 425 West Washington street, Suffolk, Va., manufacturer of vacuum ventilating devices, does not yet have its new brass and aluminum foundry under construction. It will build a new foundry in the near future which will be 60 x 70 feet. The company is in the market for the necessary equipment. (Noted Nov. 1.)

Hahn Foundry Co., Canton, O., has been incorporated with 300 shares of common stock and $500 capital by T. J. Hahn, J.G. Yost, J. C. Randles and Vincent Matejcik, to engage in general foundry work.

Grimes & Harris Inc., Leominster, Mass., has been incorporated with $10,000 capital to operate a foundry and machine shop, manufacture castings, etc. Lucius B. Grimes, 20 Boutelle street, is president.

Semler Co., Jeannette, Pa., manufacturer of steam and drainage fittings, is building an addition 50 x 125 feet, to its foundry. It is of brick and steel construction and the approximate cost will be about $15,000.

A brass, bronze and aluminum foundry is under way on East Pontiac street, Ft. Wayne, Ind., to be occupied by firm now being incorporated under the direction of R. S. Holland, Milwaukee. The building is 35 x 100 feet and is being constructed by Wade Amspaugh, 3132 Smith street, Ft. Wayne.

Stanley S. Cramer, Copewood and Thorne streets, Camden, N. J., is constructing a new foundry building, 40 x 80 feet, at Seventh and Bulson streets, Camden. Machinery and equipment have been ordered. (Noted Nov. 15.)

Detroit Die Casting Co., Detroit, C. H. Davis president, 442 East Jefferson avenue, started to take bids about Nov. 5 for the construction of a one and 2-story plant and office building to cost about $75,000.

Allied Die Cast Co. of America, 7420 Melville avenue, Detroit, recently incorporated, advises through C. M. Sorenson that it is leasing space for the present and purchasing equipment, but plans to build soon as possible.

Milwaukee Gray Iron Foundry Co., Thirty-ninth avenue, Milwaukee, is building an addition, 35 x 130 feet, to its cleaning room and an addition to its core room. Building construction will cost about $10,000 and the equipment $4000. All equipment has been ordered.

Oakley Valve & Foundry Co., 48 Ferguson street, Newark, N. J., manufacturers of poppet valves for internal combustion engines, will manufacture nonferrous, nickel and monel metal castings. No construction work is contemplated. (Noted Oct. 15.)

Service Foundry Co., New Orleans, recently incorporated to manufacture gray iron, bronze and aluminum castings for the jobbing trade, has started production. It has a new plant, 125 x 127 feet, at 1153 South Cedar street. Morris J. Rabe is in charge.

Kellam & Moore Foundry Co., Park street, High Point, N. C., has started production of gray iron, brass and aluminum castings in the plant it has leased from the Industrial Electric & Machine Co. Its output is for the jobbing trade. C. E. Kellam is in charge.

Acme Steel Co., Grassmere, Pa., manufacturer of electric steel castings, advises it is making two additions to its foundry, one, 80 x 200 feet, the other, 40 x 80 feet. Core ovens, an annealing oven, a crane, air compressor and other auxilliary equipment will be installed.

Lakeside Malleable Casting Co., Twenty-third and Clarke streets, Racine, Wis., is building a shop addition, 60 x 80 feet, and an addition to the pattern storage vault, 40 x 60 feet. The plant now is doing all of the work formerly done by the Wisconsin Malleable Iron Co., Milwaukee, the shop of which was badly damaged by fire. A decision to rebuild the Milwaukee plant will not be made before next spring.

The proposed cast pipe plant to be erected at Chelsea, Mass., by the Intercontinental Pipe & Mining Co., American subsidiary of the Pont-A-Mousson interests in France, will devote its production entirely to sand spun pipe. The process will differ from that employed by certain leading plants in this country. The plant will produce pipe ranging from two to 24 inches in diameter and will have an initial annual capacity of 100,000 tons. Officials expect to increase this capacity later to 150,000 tons. Work on the plant may not begin until February.

George H. Smith Steel Casting Co., 500 Clinton street, Milwaukee, and its subsidiary, the Trackson Co., have purchased a 21-acre site at Chase street and Holt avenue, at the southern city limits of Milwaukee. Initial construction work on a new plant will begin about March 15. The Smith company was established in 1898 and is one of the oldest operating steel casting concerns west of Pittsburgh. Its principal business is supplying parts to manufacturers of construction equipment, such as track shoes, sprockets, dipper teeth, bucket lips, gears, frame castings, etc. The company pioneered and still specializes in the production of dynamo steel, which has high magnetic permeability.

New Trade Publications

ARC WELDERS—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has issued a folder on its 300 and 400 ampere, alternating or direct current, stationary or portable, single-operator arc welding machines. The specifications of each type are described.

ELECTRIC HOISTS—Hoist & Crane Engineering Co., New York, has issued a set of data sheets descriptive of devices and methods for electrifying overhead track for electric hoists and cranes. These are of value for engineers designing such industrial installations.

ARC-WELDING ACCESSORIES — General Electric Co., Schenectady, N. Y., recently issued a folder on its arc-welding accessories. The apparatus described includes helmets and hand shields, welders glass, electrode holders, welding cable, etc.

ELECTRIC MOTORS—Wagner Electric Corp., St. Louis, has issued a bulletin describing its large single phase repulsion-induction motors. It contains illustrations and detailed description of parts. It also serves as a textbook on single phase motors, covering many features of history and construction in its various stages of development.

ELECTRIC CONTROLLING APPARATUS—Allen-Bradley Co., Milwaukee, Wis., has issued a loose-leaf folder of bulletins that it has published during the year 1929. It is divided into eight sections covering manual and automatic starters for direct current machines, mill and crane controllers and rheostats for both direct and alternating current machines, battery charging and testing equipment, manual and automatic starters for alternating current machines and the final division is devoted to accessories.